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ILLUSTRATIONS OF FUNGI—XXVII

WILLIAM A. MURRILL

The accompanying plate shows several species of white-spored gill-fungi painted by Miss Eaton in their natural colors from specimens collected in or near New York City.

Chanterel Chantarellus (L.) Murrill

Cantharellus cibarius Fries

EDIBLE CHANTEREL

Plate 11. Figure 1. × 1

Pileus fleshy, firm, turbinate, nearly plane, sometimes depressed, gregarious, cespitose at times, 3–8 cm. broad; surface glabrous, luteous, rarely paler yellow, margin involute to expanded, undulate; context white, nutty or slightly acrid, edible; lamellae thick, narrow, distant, decurrent, forked or irregularly anastomosing, luteous, or sometimes much paler; spores ellipsoid, somewhat irregular, smooth, pale-ochraceous, 8–10 × 4–5 μ; stipe attenuate below, glabrous, concolorous or paler, solid, 2.5–5 cm. long, 6–12 mm. thick.

Common throughout temperate regions in deciduous or coniferous woods, especially in dense evergreen thickets, appearing in mid-summer. It is egg-yellow all over, and has peculiar narrow, blunt, decurrent lamellae. This species has long held a high reputation for edibility, and the only poisonous species with which it may be easily confused is *Chanterel aurantiacus*. It should be

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stewed for nearly an hour and seasoned with butter or meat gravy. It is an excellent addition, also, to hashes, meat stews, and omelets.

Clitocybe virens (Scop.) Sacc.

Clitocybe odora (Bull.) Quél.

FRAGRANT CLITOCYBE

Plate 11. Figure 2. × 1

Pileus fleshy, tough, convex, becoming plane or nearly so, obtuse or subumbonate, scattered or subgregarious, 4–7 cm. broad; surface glabrous, moist in wet weather, green or dingy-green, fading with age or on drying, margin even, regular or sometimes wavy; context whitish, the odor pleasant like anise; lamellae thin, crowded, adnate or slightly decurrent, white or becoming pallid; spores 6–8 × 4–5 μ; stipe equal or slightly thickened at the base, stuffed or hollow, elastic, glabrous, whitish or greenish, 2.5–5 cm. long, 4–8 mm. thick.

A woodland species of unusual and beautiful colors found in the eastern United States from Maine to North Carolina and west to Michigan. Peck called it *Clitocybe anisaria* because of its agreeable odor. This species has appeared regularly each year among the leaves in a small grove of young birch trees at the edge of the Hemlock Grove in the New York Botanical Garden.

Prunulus purus (Pers.) Murrill

Mycena pura (Pers.) Quél.

PURE PRUNULUS

Plate 11. Figure 3. × 1

Pileus fleshy, thin, campanulate or convex to expanded, obtusely umbonate when young, 2–5 cm. broad; surface smooth, glabrous, of uniform color, varying from rose to rose-purple, violet, or lilac, margin striate, upturned with age; lamellae rather broad, adnate to sinuate, sometimes wavy and crenate on the edges, venose-connected, varying from white to shades of rose or violet, sometimes white on the edges; spores oblong, hyaline, 7–9 × 3–3.5 μ; cystidia subcylindric, 30–40 × 13–15 μ; stipe firm, smooth, subglabrous, concolorous, hollow, somewhat villose at the base, 5–8 cm. long, 2–4 mm. thick.

This beautiful species is common on the ground in woods throughout temperate North America, occurring in various forms and colors. It was figured and described in Mycologia **7**: 117. *pl. 158, f. 3,* but is included here because the drawing gives a better idea of the plant. Another species, *Prunulus denticulatus,* which is found at times in northern New York, is closely related and similar in color, but has a livid-purple cap and blackish-violet gills.

Gymnopus dryophilus (Bull.) Murrill

Collybia dryophila (Bull.) Quél.

OAK-LOVING GYMNOPUS

Plate 11. Figure 4. × 1

Pileus thin, convex or nearly plane, sometimes with the margin elevated, irregular, obtuse, commonly gregarious, 2.5–5 cm. broad; surface glabrous, varying in color, commonly some shade of bay-red or tan-color; context white, edible; lamellae narrow, crowded, adnexed or almost free, white or whitish, rarely yellowish; spores ellipsoid, 6–7.5 × 3–4 μ; stipe glabrous, yellowish or rufescent, commonly similar in color to the pileus, equal or sometimes thickened at the base, cartilaginous, hollow, 2.5–5 cm. long, 2–4 mm. thick.

This species has been discussed twice before in this series (Mycologia **3**: 101 and **4**: 164), but in neither case was the true *G. dryopohilus* as at present limited correctly figured. It occurs commonly in woods and groves throughout temperate North America and is often used for food, although there are several closely related species that have not been sufficiently tested for their poisonous or edible qualities.

Cortinellus rutilans (Schaeff.) P. Karst.

Tricholoma rutilans (Schaeff.) Quél.

REDDISH CORTINELLUS

Plate 11. Figure 5. × 1

Pileus fleshy, campanulate, becoming plane, 5–10 cm. broad; surface dry, at first covered with a dark-red or purplish tomentum,

then somewhat squamulose, sometimes yellowish with age, margin thin, at first involute; context yellow, taste mild, odor none; lamellae crowded, rounded, white to yellow, thickened and more or less villose and serrulate on the edges; spores globose or subglobose, 6–7.5 × 6–6.5 μ; stipe somewhat hollow, nearly equal or slightly thickened or bulbous at the base, pale-yellow, variegated with red or purplish, floccose squamules, 5–10 cm. long, 10–16 mm. thick.

A large and conspicuously colored species found on or about old stumps in coniferous or mixed woods from Maine to North Carolina and west to Colorado and Washington. It should be readily recognized by the colors of its upper and lower surfaces and the serrulate, villose edges of its gills.

Gymnopus strictipes (Peck) Murrill

Collybia strictipes Peck

STRAIGHT-STEMMED GYMNOPUS

Plate 11. Figure 6. × 1

Pileus thin, broadly convex to nearly plane, cespitose, 2.5–6 cm. broad; surface glabrous, sometimes slightly rugose on the disk, moist but scarcely hygrophanous, whitish or pale-yellow, paler when dry, often more deeply colored on the disk; lamellae thin, close, adnexed or almost free, white; spores ovoid or subellipsoid, pointed or subacuminate at one end, 6–7.5 × 4 μ; stipe glabrous, slightly mealy or pruinose at the apex, white, often with a dense, white, mycelioid tomentum at the base, equal, straight, hollow, 3–6 cm. long, 4–6 mm. thick.

This species occurs in clusters among dead leaves or on decayed wood in woods from New England to the District of Columbia and west to Ohio. The stipe is quite characteristic, being very erect and regular in shape and somewhat translucent in appearance.

NEW YORK BOTANICAL GARDEN.

AN UNDESCRIBED TIMBER DECAY OF PITCH PINE[1]

L. O. Overholts

(With Plates 12 and 13)

In the vicinity of State College, Pennsylvania, the pitch pines (*Pinus rigida*) are dying rather rapidly, especially in the more open woodlands. Most of these trees are fairly mature and the cause of their death has not been satisfactorily determined. The effects of the pine bark borers are very evident just beneath the bark of the dead trees, but whether or not they are responsible for the injury cannot be stated at present. Within a few months after the trees die, and while they are yet standing, they often become heavily infected with the "blue stain" fungus (*Ceratostomella pilifera*) as evidenced by the extensive bluing of the sap wood. After the dead trees fall they are subject to the attacks of several of the wood-destroying fungi. The most important of these are *Polyporus abietinus* (Dicks.) Fries and *Polyporus amorphus* Fries. In fact, the sporophores of these two species are the only ones that have ever been found on timber decayed in the manner described in this article. The decay produced by *P. abietinus* is well known and abundant on both pine and hemlock wood in this vicinity. It is entirely unlike the decay described here and cannot be considered in this connection. The decay produced by *P. amorphus* has not been studied in pure culture inoculations but the evidence at hand is such as to leave no doubt that the effects here described are due to the mycelium of that fungus.

The Fungus and Its Identification

Polyporus amorphus has been considered to be quite rare in this country. Specimens submitted to the New York Botanical

[1] Read before the Botanical Society of America at the New York meeting, December, 1916. Contribution from the Department of Botany, The Pennsylvania State College, No. 11.

Garden within the past year were reported as the first to be received from America. Through the kindness of Dr. Murrill I have been able to compare my specimens with specimens of European origin communicated by Bresadola, and the two are identical. Mr. C. G. Lloyd of Cincinnati, Ohio, has reported the species from different localities in this country. More recently Long[2] has reported that a fungus identified as *P. amorphus* was found rotting slash of the short-leaf pine in Arkansas. At the writer's request specimens from the Arkansas collections were sent for study. No evidence was found that the fungus is not the species in question, but the sporophores are not well developed and a positive determination of Mr. Long's specimens is impossible at this time. Hitherto it had appeared doubtful if the species had so much of a southern range. Present indications are that when well studied its range will be mostly confined to southern Canada, New England, and the states bordering on the Canadian line.

In the vicinity of State College the species is not rare. Probably its small size and resemblance to related species have often caused it to be overlooked or wrongly determined. In the herbarium of the Pennsylvania State College there are at least six different collections of the species and the writer's herbarium contains half as many more. It is probably a safe statement that at present as many collections are known from Pennsylvania as from all other parts of the United States combined. From this it might appear that the species can be of very little economic importance as a producer of timber decay, but it must be borne in mind that very few localities in the United States have been thoroughly explored in a mycological way. Indeed, if the prevalence of the fungus in the vicinity of State College can be regarded as a criterion of its occurrence in other localities of the same latitude it may even happen that the species is one of the more common ones where different species of pines are native. The fact that the fungus is not confined to the wood of pitch pine adds interest in this connection. One collection has been made from the wood of white pine (*Pinus Strobus*), one

[2] Long, W. H. Investigations of the rotting of slash in Arkansas (U. S. Dept. Agr. Bul. 496, p. 8, 1917).

from an old stump of table mountain pine (*Pinus pungens*), and one from a log of hemlock (*Tsuga canadensis*). These last three collections were among the first to be made and at that time no special attention was given to the type of decay produced. Consequently, material is yet lacking by means of which a comparison might be made of the characteristics of the decay in the wood of other coniferous species. There is no reason for assuming, however, that any essential difference could be detected.

The sporophores of the fungus are in some respects quite variable, yet they can be distinguished with ease after their characters are once known. When well developed the sporophore is sessile, but often it is extensively effused-reflexed and sometimes resupinate. Where the pine log lies flat on the ground the fungus is apt to spread itself over needles and chips of pine that happen to lie adjacent to the log. The color of the pileus is gray due to the covering of a grayish tomentum arranged in narrow concentric zones. The hymenium varies in color from flesh-color to orange or brick-red. According to European authorities it may at times be white or cream-colored, but such colors have been observed only in old weathered specimens of our plants. It is quite probable, however, that the depth of color developed is more or less dependent on the abundance of light. At times, and especially when growing over chips and needles of pine, an abundant development of rhizomorphs takes place. These are yellow or light orange in color, cylindric in shape and vary up to almost one millimeter in diameter. The fungus may be described, as follows:

POLYPORUS AMORPHUS Fries

Pileus coriaceous, sessile, effused-reflexed, or occasionally resupinate, 0–2 × 1–3 × 0.1–0.3 cm.; surface whitish or cinereous, villose-pubescent or tomentose, marked with narrow concentric zones; context white, 1–2 mm. thick; tubes less than 2.5 mm. long, the mouths angular, thin walled, flesh-color to orange or brick-red, averaging 2–4 per mm.; spores allantoid, hyaline, 4–5 × 1–2 μ; cystidia none; hyphae not much branched, 3–5 μ.

On wood of pine (*Pinus rigida, P. Strobus,* and *P. pungens*) or running over chips and needles of pine; rarely on wood of other coniferous trees. Probably confined to the northern United States and southern Canada.

Superficially the fungus bears some resemblance to *Polyporus dichrous* Fries, and sometimes the hymenium is perhaps inclined to be somewhat waxy in consistency, but it does not peel off in a thin smooth layer in fresh specimens and the color is usually not the same. Moreover, *P. dichrous* is confined to the wood of deciduous trees. Immature specimens bear some resemblance to certain species of *Merulius* and one such collection was once referred to a species of that genus, but determinations of such immature material are always to be taken with certain reservations until better material is obtained.

NAME USED IN DESIGNATING THIS DECAY

From the standpoint of convenience and simplicity it would be well to have some common name to apply to the decay caused by each of the wood-rotting fungi. Such names should be based on some conspicuous character of the decay. This feature probably can never be carried out in entirety because of the great similarity among the decays produced by several different fungi. For example, decays produced by *Polyporus versicolor* and a number of related species do not differ conspicuously among themselves nor from the decays produced by three or four of the common pileate species of *Stereum*. But the idea should be carried out so far as possible.

Because of the peculiar appearance of the rotted wood it is proposed to designate the decay caused by *Polyporus amorphus* as the "stringy rot" of pitch pine.

MACROSCOPIC CHARACTERS OF THE DECAYED WOOD

While observations are not complete, the fungus has so far been found attacking only the sapwood of the fallen pines. It has never been found on standing trunks and attempts at locating the mycelium in the sound heart wood have so far failed. Where it attacks the smaller branches in which heart wood has not been formed, it, of course, penetrates entirely through the wood.

As the pine logs lie on the ground one can never judge, even by tapping with a hammer, to what extent the wood is decayed. The outer layers of the sapwood usually form a firm but thin

shell made up of wood that is apparently nearly sound. This is probably because these layers have too low a water content for the growth of the fungus. That this surmise is correct is borne out by the fact that where the thick bark of the pitch pine remains as a protective covering on the trunk the outer layers of sapwood are decayed to a considerable extent. The bark falls off rather readily in the pitch pine, especially if the tree stands for several months after it dies. Consequently, in cases where the decay is well advanced the bark is generally lacking and the more sound shell of sapwood is present.

The sound dried sapwood of *Pinus rigida* is of a very light color and contrasts strongly with the brownish red color of the less extensive heartwood. One of the conspicuous characteristics of the decay is the change in color of the diseased sapwood from the normal light color to a shade that matches exactly the "cinnamon buff" of Ridgway's color manual. Since those decays in which delignification of the woody elements takes place result in a whitening of the diseased wood, it can be conjectured at once that the action in this case is at least in part not one of delignification but one in which cellulose is one of the chief elements dissolved.

The most conspicuous feature of the decay is now to be described. When a mass of the decayed wood is examined and attention directed to a lateral view of a rough radial section one sees very narrow bands of fairly firm wood between which the woody elements have been almost entirely removed. In other words, narrow bands of sounder wood alternate with long narrow cavities, neither band nor cavity with a thickness of more than one millimeter. Into these cavities or furrows project small bits of wood, often triangular in outline. The frequency of their occurrence and their form suggest that they are medullary rays. Under the microscope they are seen to be composed mostly of vertical tracheids bound together by the remains of the ray tracheids. The parenchyma cells of the rays have disappeared and the vertical tracheids are well filled with mycelium and are seen to be in a state verging on collapse.

The alternating elongated cavities and bands of wood are the characteristic marks of the decay and have suggested the name

"stringy rot." As will be brought out later, the bands of wood remaining are the areas of summer wood, which probably because of its compactness is not so easily destroyed. The elongated cavities represent the spring wood that is destroyed long before the summer wood disappears. It is evident that this separation of spring and summer wood results in the formation of concentric rings in the wood. These rings do not coincide entirely with the annual rings but the annual rings are split into their two growth areas, spring and summer wood. Consequently it is often possible to separate blocks of rotted wood into concentric slabs, although the persistence of groups of vertical tracheids bound together by ray tracheids aids in holding these concentric rings together.

In addition to the above characteristics, the rotted wood may be described as soft and watery in texture when found in the woods. It is quite flexible and readily separates into narrow strings or strands when twisted, often giving a rough broom-like appearance. When dry the well rotted wood is brittle and snaps under slight pressure. No concentric or other cracks due to shrinkage are present as are found in some rots (e. g., that caused by *Polyporus sulphureus, P. borealis,* etc.) Neither are sheets of mycelium ever developed in the cavities that appear. In rare cases small strands of mycelium may appear just under the bark or in the very rotten wood. No spots or colored lines of any sort are present in the decayed wood.

MICROSCOPIC CHARACTERS OF THE DECAYED WOOD

The wood of pitch pine is made up of two elements, i. e., vertical tracheids and medullary rays. The vertical tracheids have a single row of bordered pits on the radial walls. Consequently the radial section alone will show these pits in surface view. When the lignin and cellulose tests[3] are applied to the

[3] The lignin test found most serviceable was the phloroglucin test with hydrochloric acid. Free hand sections of the wood were first treated with a two per cent. solution of phloroglucin in 95 per cent. alcohol. This was immediately drained off and a drop of rather strong HCl added. The result was a beautiful red color assumed by all lignified membranes.

The best cellulose test was found to be the reaction with chlor-iodide of zinc solution made up as recommended in Steven's Plant Anatomy. If

sound wood of *Pinus rigida* the vertical tracheids give the reaction for lignin with the exception of the inner surface of the bordered pits. These remain practically uncolored in the center but most of them show a narrow ring of red at the outer margin. In sections showing the structure of the tracheid walls the middle lamella, secondary lamella, and tertiary or inner lamella all give a lignin reaction that varies in intensity in the different parts. Consequently there is little free cellulose in the vertical tracheids. The medullary rays of the sound wood of pitch pine are bordered above and below with one or more series of horizontal ray tracheids with inner walls conspicuously denticulate as is characteristic of the pitch pine group. These give a definite lignin reaction and do not respond to the cellulose test. The ray parenchyma cells, on the other hand, soon develop the characteristic lavender-violet color when treated with chlor-iodide-zinc solution. Consequently they are composed of unmodified cellulose. These reactions of the sound wood serve as a basis of comparison for detecting changes in the wood decayed by the fungus.

When the wood becomes infected with the mycelium of the fungus the medullary rays are first attacked. The ray parenchyma cells disappear rapidly as can be readily seen either in tangential or radial sections of the wood. The cells that still persist in the angles of the rays as seen in tangential section are ray tracheid cells. Their lignified nature enables them to withstand the attacks of the mycelium for a somewhat longer time. Undoubtedly the rot progresses rapidly inward along the line of the medullary rays. In radial section these hyphae can readily be traced within the cavity formerly occupied by the ray cells and are seen to send off frequent branches into and between the vertical tracheids of the spring wood. The intercellular hyphae enter the tracheids either through the bordered pits or apparently by simply dissolving a hole through the wall, as many such irregular holes can be seen and how they could otherwise originate is not plain. As the hyphae pass through the bordered pits these rapidly become disorganized and many different

cellulose is present it becomes a bluish-lavender color in this solution. Usually the reaction is slow in appearing and increases to a maximum intensity in a very few minutes. The sulphuric acid-iodine test was also used but found much less satisfactory.

stages in their dissolution are readily found in radial section. They are represented in plate 13, figure 3. The disintegration takes place in a more or less centrifugal direction but evidence of dissolution in the outer ring of the border is evident before the more central parts are entirely destroyed.

After entering the tracheids, growth takes place in a vertical direction and so the mycelium rapidly reaches hitherto unattacked medullary rays. At such points one to several hyphal branches are given off to the medullary rays or, as seen in plate 13, figure 1, the main hypha may enter the ray and pass through and out on the opposite side, following the same vertical direction as before but in another line of vertical tracheids. In this manner it is not impossible to trace the hyphae for rather long distances in a vertical direction.

In the meantime the rays first attacked have been practically all destroyed. Soon after the ray parenchyma cells disappear the ray tracheids show evidences of disintegration. Their complete dissolution usually occurs about the time the bordered pits in the vertical tracheids of the near vicinity are being disintegrated. In many cases, however, their lateral walls persist much longer and apparently result in binding together a small bundle of tracheids. These bundles may persist even after the spring wood of a given annual ring has been destroyed so that they project into the resulting cavity and are quite conspicuous, as mentioned under the description of the macroscopic appearance of the decayed wood and as shown in plate 12, figure 2 (left).

When a fairly advanced stage of the decay is studied it is seen that the medullary rays have practically entirely disappeared and the vertical tracheids are in a state of collapse. Prior to this time no free cellulose can be detected in these tracheids. In later stages of decay, however, the reaction to the chlor-iodid-zinc solution is distinctly positive and the remains of the tracheid wall as seen in surface view is colored a uniform lavender-violet. This, of course, means that the lignin has been removed from these walls. It probably does not indicate that cellulose destroying enzymes are not present later, else the wood would not eventually be entirely destroyed. On the other hand, it seems justifiable to conclude that the mycelium at practically every stage of

its growth produces both types of enzymes but that in the young mycelium more of the cellulose destroying enzyme is produced while in later stages the lignin destroying enzyme is produced in larger quantities.

Eventually the tracheids in the spring wood are entirely destroyed and long narrow cavities are formed in the space it formerly occupied. The summer wood is attacked before the spring wood is destroyed and it may even be possible that mycelium enters it as early as it does the spring wood. But the more compact structure of the former makes it able to withstand the attacks of the fungus for a much longer time. Even after the spring wood is entirely destroyed the summer wood is quite firm, although it has changed to the cinnamon-buff color and has become quite brittle. Because its destruction is such a long drawn out process it may even be doubted whether in a state of nature it is ever entirely destroyed by this fungus. Longer periods of exposure might result in the entrance of other organisms through which the decay would be hastened and eventually completed.

SUMMARY

Polyporus amorphus cannot yet be said to be a common fungus in this country since only a few collections are known. It is probable, however, that it is more common than these collections would indicate. Indications are that its range will be southern Canada, New England, and the states bordering on the Canadian line.

The fungus causes a characteristic decay of the sapwood of *Pinus rigida,* and has been collected also on wood of *P. Strobus, P. pungens,* and *Tsuga canadensis.*

In external appearance the decayed wood is darker in color than sound wood and is of a cinnamon-buff color (Ridgway). The spring wood is completely decayed long before the summer wood disappears. This results in the formation of concentric cavities alternating with the bands of firmer summer wood, and has suggested the name "stringy rot."

Microscopic examination and microchemical tests establish the fact that the fungus first dissolves out the cellulose of medullary

rays, then the bordered pits. The lignified structures including the ray tracheids and the vertical tracheids are then attacked and eventually (at least in the spring wood) entirely destroyed. Consequently it is believed that cellulose dissolving enzymes are produced in quantity by the younger mycelium, although probably a lignin dissolving enzyme is not entirely absent. In later stages of decay a lignin dissolving enzyme is produced in greater quantities.

STATE COLLEGE, PA.

EXPLANATION OF PLATES

PLATE 12

Fig. 1. Sporophores of *Polyporus amorphus* showing its effused-reflexed habit and the concentrically zoned pileus.

Fig. 2. Wood of pitch pine decayed by *Polyporus amorphus*. The elongated cavities alternating with bands of the sounder summer wood are quite conspicuous.

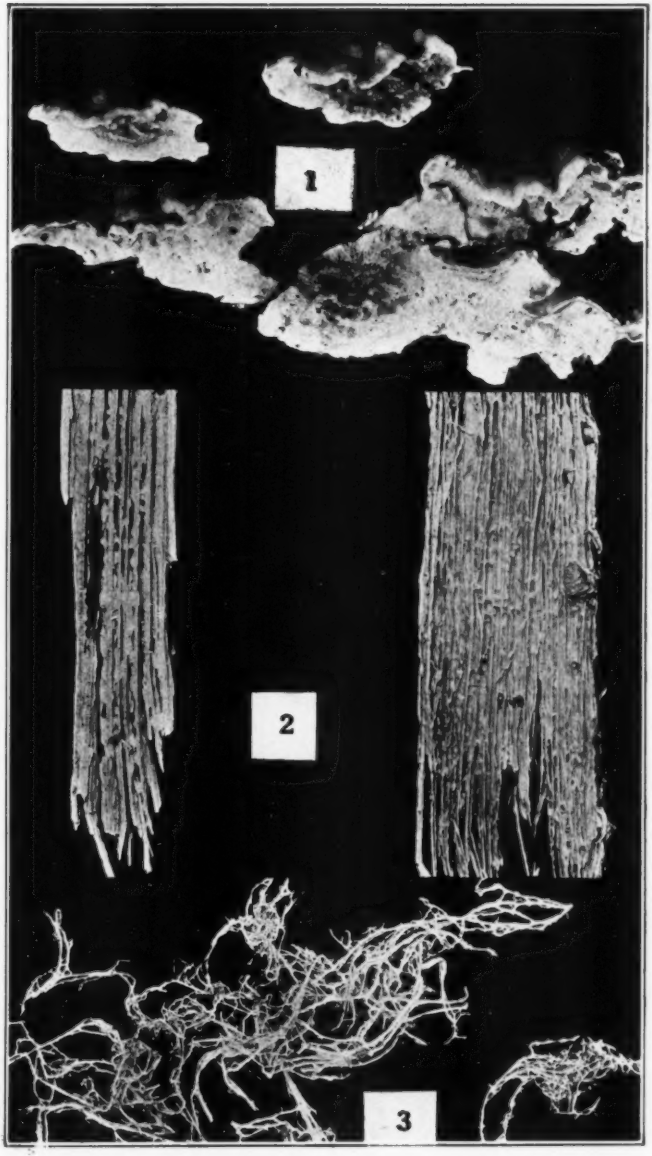
Fig. 3. Rhizomorphs of *Polyporus amorphus*.

PLATE 13

Fig. 1. Camera lucida drawing of a tangential section of pitch pine wood rotted by *Polyporus amorphus*. The parenchyma cells of the medullary rays have entirely disappeared. Ray tracheid cells still persist in the angles of some of the rays. The branching of the hyphae at the rays is conspicuous.

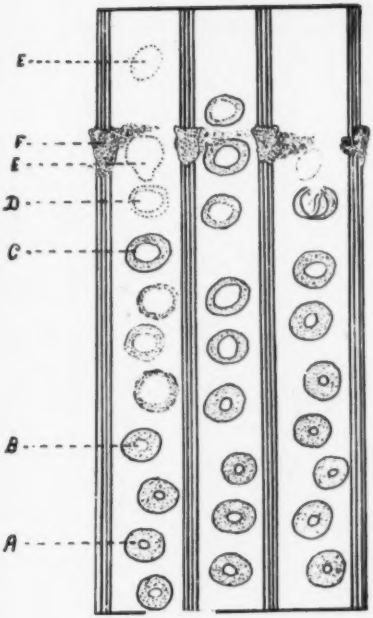
Fig. 2. Camera lucida drawing of a radial section of wood rotted by *Polyporus amorphus*. Various stages in the destruction of the bordered pits are seen at *A–E*. At *F* note remains of a medullary ray.

Fig. 3. Drawing of a radial section of wood rotted by *Polyporus amorphus*. Earlier stage of decay than figure 2. The parenchyma cells have disappeared from between the ray tracheids (R. T.), leaving the cavity *M*. The tracheids still show the characteristic denticulate wall of pitch pines. *P* is a pit in the wall of a ray tracheid. *H*, a large hypha running through the medullary ray.



POLYPORUS AMORPHUS FRIES

1



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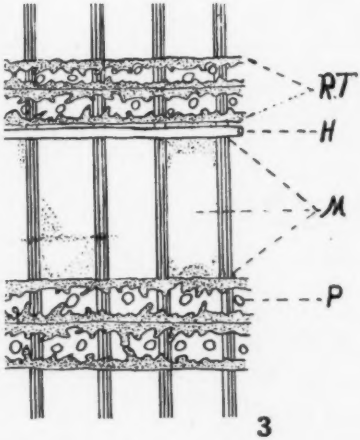

3

POLYPORUS AMORPHUS FRIES

NOTES ON NEW OR RARE SPECIES OF GASTEROMYCETES

W. H. Long

For several years the writer has had in his herbarium three species of *Gasteromycetes,* collected in Texas, two of which are undescribed. Lack of time has prevented an earlier discussion of them.

Geasteroides gen. nov.

Peridium double; exoperidium splitting into starlike, reflexed, persistent segments; endoperidium more or less deciduous, fragile, upper half usually splitting into fragments which cling to inner surface of exoperidium when it expands, basal portion of endoperidium persistent and attached to a corky sterile base, mouth single, columella and capillitium present.

Geasteroides texensis sp. nov.

Exoperidium thick, rigid, coriaceous, subhygrometric, outer surface ocher-colored to whitish in old specimens, often with an outer thin layer of arachnoid mycelium and dirt that peels off as the plants mature, 4–10 cm. in diameter when expanded, splitting into 7–10 unequal and strongly recurved segments with incurved tips, segments about one half as long as entire exoperidium, convex above and concave beneath when fully expanded, inner surface of exoperidium dark brown, fissured and cracked when dried; endoperidium seated on a short subligneous stipe which broadens out into a top-shaped, persistent, corky, sterile base, top-shaped base including stipe and gleba 1–3 cm. tall by 1–3 cm. broad, endoperidium whitish to brownish, very fragile, apparently with a poorly defined mouth, upper part of endoperidium breaking away either when the exoperidium opens or soon thereafter, leaving the prominent sterile base crowned with the subglobose columella and spores attached to the convex center of the exoperidium, cells of sterile base next to stipe very small and whitish; mature gleba dark purplish-brown, in very old weathered specimens entirely disappearing and leaving only the sterile top-shaped base seated on the stipe, or sometimes the sterile base

breaks away entirely from the exoperidium, in which case it resembles very much the sterile base of a *Calvatia;* spores globose, faintly verrucose, brown, 3–5 μ in diameter; capillitium wine-colored to brown under microscope, threads very long, sparingly and very distantly branched, 7–10 μ thick, tapering to a slender point, septate in thicker portions, breaking up into segments some of which are 800 to 1000 μ long, walls smooth or often appearing as if filled with minute pits, lumen very small or none.

In rich, loose, sandy loam around base of old, rotting, post oak (*Quercus stellata*) stumps. Type collected at Denton, Texas, October 8, 1907, by W. H. Long (No. *2011*).[1] Other collections were made by the writer as follows: At Denton, Texas, September, 1906, and October 14, 1907 (Nos. *1671* and *2034*). The distinguishing features of this plant are its prominent persistent corky sterile base and its deciduous fragile endoperidium. It is a *Calvatia* among the geasters.

The genus is closely related to *Geasteropsis* Hollos, but differs from this plant in having a sterile persistent base to which the lower part of the endoperidium is firmly attached. According to the description and figures given by Hollos,[2] the dehiscent endoperidium of *Geasteropsis* encloses the subligneous stipe and columella making quite a different plant from the one here described.

Arachniopsis gen. nov.

Plants subglobose, terrestrial, peridium double, outer or exoperidium fragile, more or less deciduous; endoperidium cartilaginous, opening irregularly at apex; gleba consisting of a powdery mass of spores and capillitium without either columella or peridioles.

Arachniopsis albicans sp. nov.

Plants subglobose to irregularly globose, white, 5–20 mm. across, usually with a radicating base like a phalloid; exoperidium mealy to powdery, white, gradually weathering off; endoperidium cartilaginous, often very thin at apex, splitting into several irregular tooth-like segments at top, which are more or less incurved onto the gleba; gleba powdery, drab *en masse* consisting of spores and capillitium; spores subhyaline, with a greenish

[1] Unless otherwise stated all of the herbarium numbers cited in this article refer to the herbarium numbers of the writer.

[2] Hollos, L. Növényt. Közlem. 2: 72–75. 1903.

tinge, obovate to subglobose, 3–5 μ long by 3–4 μ broad, faintly verruculose; capillitium present but rather scanty, hyaline, distantly septate and sparingly branched, 3–6 μ in diameter, somewhat granular, often breaking up into rather short segments, walls very thin.

In black soil of prairies under wire fences. Type collected by W. H. Long at Denton, Texas, December 27, 1908 (No. *2106*). Two other collections were made by the writer under wire fences in black soil in the same locality as follows: September, 1907 (No. *2008a*), and December 23, 1907 (No. *2052*). Some twenty specimens of this interesting little species were found during 1907 and 1908. The plants resemble externally, phalloid eggs which have failed to develop, but their internal structure is quite different from that of a phalloid. All of the fences on the prairies where this plant grows are made of barbed wire. In plowing the land the soil is thrown toward the fence, thus burying a large amount of vegetable debris; it is in such localities that this plant seems to thrive best.

This plant resembles in its manner of growth an *Arachnion*, but differs from this genus in having a true capillitium, a cartilaginous endoperidium, and no peridioles. Its peculiar habitat, its small size, and general resemblance to *Arachnion album* probably explain why it has not been found before.

LYSURUS TEXENSIS Ellis (?)

"Eggs" in groups of several individuals, white, about 1 inch in diameter; stipe hollow, tapering toward base, reddish above, much paler below, 3–5 inches tall by 0.5 inch thick; walls of stipe of two layers of chambers thick, chambers 2–3 times as long as broad, opening outwardly occasionally but not inwardly, polygonal in cross section, pseudoparenchymatous, stipe crowned by a finger-like pileus; arms or fingers 4–5, at first joined by a thin membrane at apex, later separating, 0.3–0.5 inch long, tapering toward apex, hollow, pseudoparenchymatous, orange-red, transversely rugose, with a shallow furrow or suture along back of each, entirely covered by the gleba on sides and outer surface, inner faces or sides not gleba-bearing, expanding at base where joined to stipe into a thin, flat, lobed border, lobes as many as the arms and lying between their bases; gleba covering and completely hiding the outer surface of arms and border, having

much the appearance of a Phallus but when the gleba deliquesces the true nature of the pileus is seen, gleba foetid, black at maturity; spores of usual type of *Phallaceae*.

Collected in soil near a rotting strawstack, at Denton, Texas, 1907, by W. H. Long (No. *2000*). Six plants were found close together as if growing from a common mycelium, all in a semi-dried condition.

The writer has, with much hesitancy, provisionally assigned this plant to *Lysurus texensis* Ellis, since there was undoubtedly a plant of this character collected in Texas, although the description was not completed. It, however, may be only a red form of *Anthurus borealis* Burt.

LATERNEA COLUMNATA (Bosc.) Nees

A fine specimen (dried) of this plant has just been received from Texas. It has four columns and when fresh was undoubtedly red. A detailed description is unnecessary since the specimen is typical of this well known and widely distributed species. In soil (?), collected at Houston, Texas, January, 1917, by Geo. L. Fisher and communicated by B. C. Tharp (No. *6270*, Herb. Long). *Laternea triscapa* Turp. has also been reported from Texas and is supposed to be in the Ellis collection, but apparently the specimen is lost, since previous efforts to locate it failed.[3] It was probably *L. columnata*.

Six species of phalloids are now known from Texas, viz.: *Phallus impudicus* L. var. *imperialis* Schw., *P. rubicundus* Bosc., *Mutinus caninus* (Huds.) Fries, *Simblum sphaerocephalum* Schlecht., *S. texense* (Atk. & Long) Long, *Laternea columnata* (Bosc.) Nees, and *Lysurus texensis* Ellis (?).

Type material of *Geasteroides texensis* and *Arachniopsis albicans* has been deposited in the Pathological and Mycological Collections of the Bureau of Plant Industry, Department of Agriculture, Washington, D. C.

OFFICE OF INVESTIGATIONS IN FOREST PATHOLOGY,
BUREAU OF PLANT INDUSTRY,
ALBUQUERQUE, N. MEX.

[3] Long, William H. The Phalloideae of Texas, Jour. Myc. **13**: 113. 1907.

NORTH DAKOTA FUNGI—I

J. F. Brenckle

In this list an attempt is made to bring together all known North Dakota Fungi mentioned in earlier lists and papers, as well as those collected during the past seven years. The following gentlemen have contributed to the list with papers and collections:

Prof. A. B. Seymour's "List of Fungi Collected in 1884 along the Northern Pacific R. R." probably contains the first information that any fungi existed in Dakota Territory.

Then came Mr. C. G. Lloyd's "Letters" and "Mycological Notes," which report a number of species collected by Prof. L. R. Waldron, Miss L. Perrine, and myself.

Dr. Fred J. Seaver next published "Some North Dakota Hypocreales," "Discomycetes of North Dakota," and "Slime Moulds of North Dakota." He also issued three fascicles of exsiccati under the title of "North Dakota Fungi" during his stay in the state (1907–1908).

Lists of my collections have been published by Dr. Rehm, Dr. Sydow, and Prof. Saccardo. "Fungi Dakotenses" was started after Dr. Seaver left the state.

Prof. O. A. Stevens, of Fargo, has been an active collector for some years and has added many names to the list. Dr. J. Lunell, of Leeds, has contributed a number of species. Dr. J. R. Weir, Forest Pathologist, has sent specimens and a list of tree fungi found in the Sioux National Forest which borders on North Dakota on the southwest.

The kindly encouragement and help of Mr. Lloyd, Drs. Seaver, Arthur, Farlow, Clinton, Rehm, and Saccardo have made the list possible and to them may be attributed most of the determinations.

The data accompanying the names are, the host-names or substratum, place and date of collection, and the name of the col-

lector unless collected by myself. Subscribers to the author's "Fungi Dakotenses" will kindly note certain corrections in the names of fungi and hosts.

1. PHYCOMYCETES

Albugo Blitii (Biv.) Kuntze.
On *Amaranthus graecizans, A. blitoides,* and *A. retroflexus.* Kulm, Aug. 1911; Jamestown, Sept., 1884, Seymour.
(Fungi Dak. *136, 159, 159a.*)

Albugo candida (Pers.) Kuntze.
On *Brassica arvensis* and *Capsella Bursa-pastoris.* Kulm, July, 1908.
(Fungi Dak. *27, 27a.*)

Albugo Tragopogonis (Pers.) Kuntze.
On *Artemisia biennis* and *Ambrosia psilostachya.* Kulm, July, 1912.
On *Ambrosia trifida.* Bismarck, Aug., 1915.
On *Tragopogon porrifolius.* Fargo, July, 1915, Stevens.
(Fungi Dak. *158, 193, 327, 351.*)

Basidiophora Kellermanii (Ellis & Hals.) Wilson.
On *Iva xanthiifolia.* Kulm, 1911, Sykeston, Seaver.
(Fungi Dak. *28.*)

Cladochytrium major (Schroet.) Fish.
On *Rumex brittanica.* Kulm, June, 1910.
(Fungi Dak. *138.*)

Peronospora Arthuri Farl.
On *Anogra strigosa.* Kulm, June, 1910.
(Fungi Dak. *123.*)

Peronospora calotheca DeBary.
On *Galium boreale.* Kulm, June, 1913.
(Fungi Dak. *391.*)

Peronospora effusa (Grev.) Rabh.
On *Chenopodium album.* Kulm, July, 1912.

Peronospora gangliformis (Berk.) DeBary.
On *Lactuca pulchella.* Kulm, Aug., 1908.
(Fungi Dak. *390.*)

Peronospora leptosperma DeBary.
On *Artemisia biennis* and *A. ludoviciana.* July, 1912.
(Fungi Dak. *197, 336.*)

Peronospora Echinosperma Swingel.
On *Lapulus Lapulus.* Jamestown, June, 1913.
(Fungi Dak. *198.*)

Peronospora parasitica (Pers.) Tul.
On *Lepidium* sp. Jamestown, 1884, Seymour.

Peronospora Polygoni Thuem.
On *Polygonum convolvulus.* Kulm, June, 1913.

Peronospora Potentillae DeBary.
On *Potentilla pentandra.* Kulm, July, 1911.

Peronospora pygmaea Ung.
On *Anemone canadensis.* Kulm, July, 1911.
(Fungi Dak. *214.*)

Peronospora Trifoliorum DeBary.
On *Astragalus caroliniana.* Kulm, July, 1915; Bismarck, Seymour.
(Fungi Dak. *337.*)

Peronospora Viciae (Berk.) DeBary.
On *Vicia linearis.* Kulm, June, 1909.
(Fungi Dak. *124.*)

Physoderma Eleocharidis (Fuckel.) Schroet.
On *Eleocharis palustris.* Kulm, Oct., 1910.
(Fungi Dak. *39.*)

Pilobolus crystallinus (Wigg.) Tode.
On horse manure. Kulm, July, 1916.
(Fungi Dak. *394.*)

Plasmopara Halstedii Farl.
On *Ambrosia psilostachya.* Kulm, June, 1912.
On *Helianthus annuus, H. Maximiliani* and *H. subrhomboides.* Kulm, Sept., 1912.
On *Rudbeckia hirta.* Kulm and Bismarck, 1884, Seymour.
(Fungi Dak. *199, 199a, 238.*)

Synchytrium decipiens Farl.
On *Falcata comosa.* Bismarck, Seymour and Stevens.
(Fungi Dak. *349.*)

Sclerospora graminicola (Sacc.) Schroet.
On *Chaetochloa viridis.* Kulm, August, 1909.
(Fungi Dak. *86.*)

II. ASCOMYCETES

Amphisphaeria decolorans Rehm.
On dead bark of *Salix.* Kulm, November, 1913.
On dead bark of *Cornus stolonifera.* Whitestone Gully, 1916.

Anthostoma picaceum (Cooke & Ellis) Ellis & Everh.
On twigs of *Fraxinus lanceolata.* Wirch Lake, May, 1914.
The spores have a nucleus at each end, are somewhat curved but otherwise as described in Ellis & Everh.

Ascophanus carneus (Pers.) Boud.
On horse manure. Kulm, July, 1915.
On cow manure. Sykeston, Seaver.

Ascophanus cinereus (Crouan) Boud.
On horse dung. Woods near Fargo, Seaver.

Ascophanus crustaceus Starb.
On horse manure. Kulm, July, 1915.

Ascophanus testaceus (Moug.) Phill.
On old building paper. Fargo, Seaver.

Ascobolus immersus Pers.
Collected near Sykeston by Seaver.

Ascospora pseudhimantia Rehm n. sp.
On stems of *Aster paniculatus*. Fargo, June, 1915, Stevens.

Blitrydium fenestratum (Cooke & Peck.) Sacc.
On *Populus tremuloides*. Fargo, Seaver and Stevens.
(Fungi Dak. *303*.)

Biatorella campestris (Fries.) Th. Fries.
On moss sod. Kulm, July, 1914.
(Fungi Dak. *206*.)

Calosphaeria princeps Tul.
On *Prunus americana*. Kulm, July, 1913.

Cenangium furfuraceum (Roth.) Sacc.
On *Corylus americana*. Fargo, Seaver and Stevens.

Cenangium populneum prunicolum Rehm. n. var.
On *Prunus melanocarpa*. Kulm, May, 1914.
(Fungi Dak. *209*. The host was given as *P. virginiana* but Prof. Bergman corrects this to *P. melanocarpa*.)

Ceratostoma graphioides Sacc.
On fallen twigs of *Crataegus mollis*. Kulm, April, 1913.

Ceratostoma subrufum Ellis. & Everh.
On stems of *Rubus strigosus*. Kulm, March, 1916.

Ciboria sulphurella (Ellis. & Everh.) Rehm.
On Ash leaves. Fargo and Hawk's Nest, Seaver.

Coryne sarcoides (Jacq.) Tul.
On decaying logs. Fargo, Seaver.

Cordyceps militaris (L.) Link.
On larvae of insects. Fargo woods, Seaver.

Cordyceps pistillaris Berk. & Br.
On scale-insects. Fargo woods, Seaver.

Claviceps purpurea (Fries) Tul.
On *Secale cereale*. Emmons Co., August, 1915.
On *Bromus inermis, Elymus virginicus, Agropyron occidentale,* and *A. repens*.
(Fungi Dak. *328*.)

Claviceps nigriceps Tul.
On *Eleocharis palustris*. Kulm, August, 1908.
Fungi Dak. *33*.)

Claviceps microcephala (Wallr.) Karst.
On *Calamagrostis neglecta*. Kulm, August, 1908.
(Fungi Dak. *4*.)

Creonectria Coryli (Fuckel.) Seaver.
(Rehm calls it *Chilonectria inaurata* (Berk. & Br.) Sacc.)
On *Symphoricarpos occidentalis.* Kulm, March, 1910.

Creonectria coccinea (Pers.) Seaver.
On dead wood. Fargo, Seaver.

Creonectria verrucosa (Schw.) Seaver.
On *Acer Negundo* and *Populus deltoides.* Kulm.
(Fungi Dak. *213, 282.*)

Creonectria purpurea (L.) Seaver.
On *Prunus melanocarpa.* Kulm and Fargo, Seaver.
(Fungi Dak. *388.*)

Creonectria tuberculiformis (Rehm) Seaver.
On *Urtica gracilis.* Fargo, Seaver.

Cryptosphaeria millipunctata Grev.
On *Fraxinus lanceolata.* Kulm, May, 1911.

Cryptosphaeria populina (Pers.) Sacc.
On *Populus deltoides.* Kulm, September, 1912.
(Fungi Dak. *211.*)

Cucurbitaria Caraganae Elaeagni Rehm.
On *Elaeagnus argentea.* Kulm, July, 1914.
(Fungi Dak. *306.*)

Cucurbitaria conglobata Crataegi Rehm.
On *Crataegus mollis.* Kulm, May, 1911.

Cucurbitaria Crataegi (Schw.) Ellis & Everh.
On *Crataegus mollis.* Kulm, March, 1913.

Cucurbitaria Fraxini Ellis & Everh.
On *Fraxinus lanceolata.* Kulm, April, 1906.

Cucurbitaria Negundinis Wint.
On *Acer Negundo.* Kulm, November, 1913.

Cucurbitaria occulta Oudem.
On *Shepherdia argentea.* Kulm, June, 1913.

Cucurbitaria umbilicata Ellis.
On *Chrysothamnus graveolens.* Sentinal Butte, August, 1914, Stevens.

Daldinia vernicosa Schw.
On *Quercus macrocarpa.* Fargo, Stevens.
On *Fraxinus* and *Populus,* Kulm.

Dasyscypha Ivae Rehm, n. sp.
On dead *Iva xanthiifolia.* Kulm, April, 1913.

Dasyscypha nivea (Hedw.) Sacc.
On oak wood. Hawk's Nest, Seaver.

Diatrype albopruinosa (Schw.) Cooke f. *salicina* Rehm.
On *Salix.* Kulm, October, 1911.
(Fungi Dak. *160.*)

Diatrype americana Ellis & Everh. f. *Ostryae* Rehm.
On *Ostrya virginica*. Fargo, August, 1914, Stevens.
(Fungi Dak. *307*.)

Diatrype americana Ellis & Everh. f. *Quercus* Rehm.
On *Quercus macrocarpa*. Delaney's Ranch, August, 1915.

Diatrype asterostoma Berk. & Cooke.
On *Prunus melanocarpa*. Leeds, July, 1914, Lunell.

Diatrype dakotensis Rehm, n. sp.
On *Salix*. Kulm, December, 1914.

Diatrype Hochelagae Ellis & Everh.
On *Acer Negundo*. Kulm, August, 1911.

Diatrype linearis Ellis & Everh. f. *Salicis* Rehm.
On *Salix*. Kulm, December, 1913.

Diatrype radiata Ellis.
On *Ulmus americana*. Kulm, October, 1911.

Diatrype stigma (Hoff.) DeNot.
On *Salix*. Kulm, November, 1913.

Diatrype tristicha DeNot.
On *Rosa subnuda*. Kulm, May, 1913.
(Fungi Dak. *251*.)

Diatrype tumida Ellis & Everh. f. *Populi* Rehm.
On *Populus tremuloides*. Fargo, July, 1914.

Diatrype tumida Ellis & Everh. f. *Pruni* Rehm.
On *Prunus americana*. Fargo, July, 1914.

Diatrypella Frostii Peck.
On *Corylus americana*. Fargo, November, 1916, Stevens.
(Fungi Dak. *428*.)

Didymosphaeria brunneola Niessl.
On *Apocynum hypericifolium*. Kulm, November, 1913.

Didymosphaeria crastophila Niessl.
On *Andropogon scoparius*. Kulm, November, 1913.

Dothidella ulmea (Schw.) Ellis & Everh.
On *Ulmus americana*. Fargo, Spring, 1914.
(Better called "*Gnomonia ulmea* (Schw.) Thuem. see "Die Dothideales."
Ann. Mycol. **13**: 325. 1915.
(Fungi Dak. *329*.)

Dimerosporium Collinsii (Schw.) Sacc.
On *Amelanchier alnifolia*. Fargo, June, 1915.

Epichlae typhina (Pers.) Tul.
On *Koeleria cristata*. Kulm, June, 1909.
(Fungi Dak. *54*.)

Erysiphe Cichoracearum DC.
On the following hosts at various places: *Aster longifolius, A. multiflorus, A. paniculatus, Ambrosia trifida, Artemisia longifolia, Circium Floodmani, Grindelia squarrosa, Helianthus annuus, H. Maximiliani, H. tuberosus, Hydrophyllum virginicum, Iva xanthiifolia, Lactuca scariola, L. spicata, Plantago asiatica, P. major, Ratabida columnaria, Solidago Canadensis, S. mollis.*
(Fungi Dak. *139, 277, 277a, 161, 161a, 308, 308a, 308.*)

Erysiphe Cichoracearum f. *Galeopsidi* (DC.) Salmon.
On *Stachys palustris.* Kulm, August, 1911.
(Fungi Dak. *162.*)

Erysiphe communis (Wallr.) Fries.
On *Anemone canadensis.* Kulm, September, 1914.
On *Glycyrhiza lepidota.* Berg, September, 1914, Stevens.
(Fungi Dak. *300, 309a.*)

Erysiphe graminis DC.
On *Poa pratensis.* Fargo, October, 1914, Stevens.

Erysiphe Polygoni DC.
On *Polygonum aviculare, P. erectum, Ranunculus abortivus, R. cymbalarius, Thalictrum purpurascens.* Fargo and Kulm, Stevens and Brenckle.
(Fungi Dak. *34, 121, 310, 378.*)

Entypa astera (Nitsch.) Fuckel.
On *Quercus macrocarpa.* Fargo, July, 1914.
(Fungi Dak. *311.*)

Eutypa Fraxini (Nitsch.) Sacc.
On *Fraxinus lanceolata.* Kulm, December, 1913.

Eutypa lata (Pers.) Tul.
On *Prunus americana* and *Quercus macrocarpa.* Kulm and Fargo.
(Fungi Dak. *163, 357.*)

Eutypa nitida Nitsch.
On *Salix.* Kulm, September, 1911.
(Fungi Dak. *164.*)

Eutypa scabrosa (Bull.) Auersw.
On *Fraxinus lanceolata.* Wirch Lake, May, 1914.
On *Salix.*

Eutypa velutina (Wallr.) Sacc.
On *Salix.* Kulm, October, 1911.

Eutypella angulosa Nitsch. f. *Negundinis* Rehm.
On *Acer Negundo.* Kulm, September, 1911.
(Fungi Dak. *165.*)

Eutypella angulosa Nitsch. f. *Fraxini* Rehm.
On *Fraxinus lanceolata.* Fargo, July, 1914.

Exoascus deformans Fuckel.
On *Prunus americana, P. melanocarpa,* and *P. Bessii.* Kulm and general in the state.

Exoascus Pruni Fuckel.
On *Prunus americana, P. melanocarpa,* and *P. Bessii.*
(Fungi Dak. *96.*)

Gibberella pulicaris (Fries) Sacc.
On *Zea Mays.* Fargo, August, 1907, Seaver.

Gloniopsis Gerardiana Sacc.
On oak. Fargo, Seaver.

Glonium lineare (Fries) DeNot.
On wood. Hawks Nest, 1908, Seaver.

Glonium parvulum (Gerard) Sacc.
On stumps. Fargo, 1907, Seaver.

Glonium stellatum Mühl.
On wood. Fargo, August, 1907, Seaver.

Galactinia succosa (Berk.) Cooke.
On soil in woods. Fargo, 1907, Seaver.

Geopyxis nebulosa (Cooke) Sacc.
On decaying log. Fargo, 1907, Seaver.

Graphyllium dakotense Rehm, n. sp.
On *Artemisia frigida.* Dickey Co., April, 1915.
On *Andropogon scoparius.* Kulm, November, 1913.
(Fungi Dak. *330.*)

Graphyllium graminis (Ellis & Everh.) Rehm.
On *Phragmites communis.* Dickey Co., November, 1914.
(Fungi Dak. *312.*)

Helotium citrinum (Hedw.) Fries.
On wood. Fargo, 1907, Seaver.

Helotium herbarium (Pers.) Fries.
On *Ambrosia trifida.* Kulm, August, 1913.

Helvella crispa (Scop.) Fries.
On moss sod. Cheyenne River, August, 1916.

Helvella elastica Bull.
On moss sod in woods. Cheyenne River, August, 1916.

Humaria deerata (Karst.) Sacc.
On old cabbage stems. Kulm, May, 1911.
(Fungi Dak. *140.*)

Humaria humosa Fries.
On moss sod. Kulm, May, 1908.

Humaria subhirsuta (Schum.) Karst.
On soil. Kulm, June, 1909.
(Fungi Dak. *141.*)

Hypocrea sulphurea (Schw.) Sacc.
On *Tilia americana.* Fargo, Seaver. Reported as *H. citrina* (Pers.) Fries.

Hypocrea patella Peck.
On old sphaeriaceous fungi. Fargo, Seaver.

Hypoderma Scirpinum DC.
On *Scirpus occidentalis*. Kulm, May, 1908.
(Fungi Dak. *142*.)

Hypomyces aurantius (Pers.) Fuckel.
On dead fungi. Woods, Fargo, Seaver.

Hypomyces Lactifluorum (Schw.) Tul.
On *Lactaria* sp. Fargo, August, 1907, Seaver.

Hypomyces ochraceus (Pers.) Tul.
On dead Agaric. Fargo, September, 1907, Seaver.

Hypomyces rosellus (Albert. & Schw.) Tul.
On logs. Fargo, Seaver.

Hyponectria dakotensis Seaver.
On *Ambrosia trifida*. Fargo, Seaver.

Hypomyces polyporinus Peck.
On *Polystictus versicolor*. Fargo, Seaver.

Hysterium Prostii Duby.
On *Cornus stolonifera*. Whitestone gully, October, 1916.

Hysteropatella Prostii (Duby.) Rehm.
On wood. Fargo, Seaver.

Hysterographium Fraxini (Pers.) DeNot.
On *Fraxinus lanceolata*. Fargo and Kulm, Seaver.
(Fungi Dak. *256*.)

Hysterographium Mori (Schw.) Rehm.
On oak wood. Fargo, Seaver.

Hysterographium Rousselii DeNot.
On dead *Salix*. Kulm, November, 1915.
(So determined by Dr. Rehm.)

Karschia lignyota (Fries.) Sacc.
On wood. Hawk's Nest, Seaver.

Karschia traveliana Rehm.
On log of Ash. Fargo, Seaver.

Lachnea albida Schaeff.
On moss sod. Anselm, August, 1916.
On wood. Fargo, Seaver.
(Fungi Dak. *407*.)

Lachnea erinaceus (Schw.) Sacc.
On log. Anselm, August, 1916.

Lachnea scutellata (L.) Sacc.
On wood and soil. Sykeston, Seaver.

Lachnea umbrata (Fries) Phill.
On soil. Kulm, May, 1910.

Laestadia Apocyni Ellis & Everh.
On *Apocynum hypericifolium*. Kulm, September, 1914.

Laestadia Scabiosae Lamb. & Faut.
On *Aster multiflorus*. Kulm, July, 1913.

Lamprospora detonia Brenckle.
On moss sod. Woods, Cheyenne river, August 13, 1916. According to Durand this is *Detonia scabrosa*.

Lasiobolus equinus (Muel.) Karst.
On horse dung. Sykeston, Seaver.

Leptosphaeria anthelmintica (Cooke) Sacc.
On *Chenopodium glaucum*. Kulm, September, 1913.

Leptosphaeria Artemisiae (Fuckel) Auersw.
On *Artemisia ludoviciana*. Kulm, November, 1913.
On *Artemisia caudata*. Glenn Ullin, July, 1915, Stevens.

Leptosphaeria borealis Ellis & Everh.
On *Salix*. Kulm, November, 1913.

Leptosphaeria Coniothyrium (Fuckel) Sacc.
On *Rubus strigosus*. Kulm, March, 1916.
(Fungi Dak. *384*.) (Not *Leptosphaeria fuscella*.)

Leptosphaeria conoidea DeNot.
On *Urtica gracilis*. Kulm, October, 1913.

Leptosphaeria consessa (Cooke & Ellis) Sacc.
On *Ambrosia psilostachya, A. trifida*, and *Helianthus subrhomboideus*. Kulm, August, 1913.
(Fungi Dak. *230*.)

Leptosphaeria culmifraga (Fries) Ces. & DeNot.
On *Agropyron tenerum*. Kulm, July, 1913.
On *Elymus hirsutiglumis*. Fargo, July, 1915, Stevens.

Leptosphaeria culmorum Auersw.
On *Elymus canadensis, Agropyron Richardsoni, Andropogon furcatus*. July, 1914.

Leptosphaeria Elymi Atk. (?)
On *Elymus canadensis*. Kulm, July, 1913.
Has spores somewhat longer and seven-septate, otherwise as described in Ellis & Everh.
(Fungi Dak. *231*.)

Leptosphaeria Erigerontis Berl.
On *Aster longifolius*. Kulm, August, 1913.
(Fungi Dak. *232*.)

Leptosphaeria Helianthi Ellis & Everh.
On Helianthus giganteus. Kulm, September, 1913.

Leptosphaeria Muhlenbergii (Ellis) Niessl.
Dr. Rehm after repeated examination of mature material sides with Niessl in placing this fungus with *Leptosphaeria* rather than *Dothidea*. (See N. Amer. Pyren., Ellis & Everh. p. 614.)
(Fungi Dak. *313*.)

Leptosphaeria nigricans inculta Sacc.
On old stems of *Grindelia squarrosa*. Kulm, August, 1913.

Leptosphaeria Onagrae Rehm, n. sp.
On *Onagra strigosa*. Kulm, July, 1913.
(Fungi Dak. *233*.)

Leptosphaeria planiuscula (Riess.) Ces. & DeNot.
On *Leptilon canadensis*. Kulm, July, 1913.
(Fungi Dak. *234*.)

Leptosphaeria tetonensis (Ellis & Everh.) Rehm.
Syn. *Melanomma occidentale tetonense* Ellis & Everh. (See N. Amer. Pyren. Ellis & Everh. p. 183.)
On *Artemisia frigida*. Kulm, November, 1908.
(Fungi Dak. *143*.)

Leptosphaeria Thalictri Winter.
On *Thalictrum dasycarpum*. Fargo, June, 1915.

Leptosphaeria trimeroides Rehm.
On *Liatris scariosa*. Kulm, August, 1913.

Leptosphaeria Typharum Karst.
On *Typha latifolia*. Kulm and Fargo, 1914.
(Fungi Dak. *334*.)

Lophiostoma Arundinis (Fries) Ces. & DeNot.
On *Phragmites communis*. Kulm, November, 1914.
On *Agropyron* sp. Kulm, October, 1915.

Lophiostoma caulicum (Fries) Ces. & DeNot.
On *Amaranthus graecizans*. Kulm, March, 1913.

Lophiostoma insidiosum (Desm.) Ces. & DeNot.
On *Aster multiflorus*. Kulm, July, 1913.
(Fungi Dak. *314*.)

Lophiostoma insidiosum f. *Salicis* Rehm.
On *Salix* sp. Kulm, December, 1913.

Lophiostoma macrostomoides DeNot.
On *Symphoricarpos*, *Salix*, and *Populus*. Kulm, 1913.
Probably identical with *L. triseptatum pleuriseptatum* Ellis & Everh.
(Fungi Dak. *147*.)

Lophiostoma Pruni Ellis & Everh.
On *Prunus americana* and *P. melanocarpa*. Kulm, 1913.

Lophiostoma Starbackii Karst.
On *Prunus melanocarpa*. Kulm, May, 1914.

Lophiostoma triseptatum pleuriseptatum Ellis & Everh.
On all the natural woods. General over the state.
(Fungi Dak. *147, 257, 314.*)

Lophiostoma triseptatum Peck. f. *Fraxini* Rehm.
On *Fraxinus lanceolata.* Wirsh Lake, May, 1914.

Macropodia macropus (Pers.) Fuckel.
On moss sod. Anselm, August, 1916.

Massaria conspurcata (Wallr.) Sacc.
On *Prunus americana.* Kulm, November, 1911.
(Fungi Dak. *166.*)

Melanomma minutum Berl.
On old *Salix.* Beaver Lake, July, 1908.

Melanomma occidentale (Ellis) Sacc.
On *Chrysothamnus graveolens.* Sentinal Butte, August, 1914, Stevens.

Melanomma pulvis-pyrus (Tetr.) Fuckel f. *Fraxini* Rehm.
On *Fraxinus lanceolata.* Kulm, April, 1908.

Melanopsamma improvita Karst.
On hail-injured apple tree. Kulm, January, 1914.

Melanopsamma salicaria (Karst.) Sacc.
On *Salix* sp. Kulm, December, 1913.

Melanopsamma salicaria (Karst.) f. *fallax* Sacc.
On *Salix.* Kulm, June, 1913.

Metasphaeria ambrosiaecola Atk.
On *Ambrosia psilostachya.* Kulm, August, 1913.

Metasphaeria ambrosiaecola Ivae Rehm.
On *Iva xanthiifolia.* Kulm, March, 1908.
(Fungi Dak. *144.*)

Metasphaeria ambrosiaecola praetans Rehm.
On *Ambrosia trifida.* Kulm, August, 1913.
Spores seven-septate.

Metasphaeria anisometra Cooke & Hark.
On *Dondia depressa.* Kulm, Aug., 1913.

Microsphaera Alni (Wallr.) Wint.
On *Corylus, Syringa, Viburnum lentago, V. prunifolium.* Fargo, Seaver and Stevens.
(Fungi Dak. *280, 280a.*)

Microsphaera Ravenelii Grev.
On *Lathyrus odoratus.* Fargo, October, 1914, Stevens.
On *Vicia linearis.* Belfield, August, 1914, Stevens.
(Fungi Dak. *281, 281a.*)

Microsphaera Symphoricarpi Howe.
On *Symphoricarpos occidentalis.* Valley City, Seymour.
(Fungi Dak. *212.*)

Mollisia atrata (Pers.) Karst.
On *Ambrosia trifida*. Fargo, August, 1907, Seaver.

Mollisia Dehnii Karst.
On *Potentilla norvegica*. Kulm, June, 1908; Fargo, Seaver. (Fungi Dak. *5*.)

Mollisia cinerea (Batsch) Karst.
On wood. Fargo, 1907, Seaver.

Nectria episphaeria (Tode) Fries.
On old sphaeriaceus fungi. Fargo, 1907, Seaver.

Nectria Peziza (Tode.) Fries.
On decaying log. Fargo, July, 1907, Seaver.

Morchella conica Pers.
On prairie. Kulm, June, 1908.

Morchella esculenta (L.) Pers.
Woods. Fargo, 1907, Seaver.

Nitschkea crustacea (Karst.) Sacc.
On old *Prunus melanocarpa*. Wirch Lake, May, 1914.

Nummularia repanda (Fries) Nitsch f. *querceti* Rehm.
On *Quercus macrocarpa*. Fargo, July, 1914.

Ophiobolus acuminatus (Sow.) Duby.
On *Circium Flodmanii*. Kulm, March, 1909.

Ophiobolus anguillides (Cooke) Sacc.
On *Ambrosia psilostachya* and *A. trifida*. Kulm, August, 1913. (Fungi Dak. *38*, *236*.)

Ophiobolus Circii (Karst.) Sacc. f. *furcatus* Rehm.
On *Circium Flodmanii*. Kulm, July, 1913.

Ophiobolus claviger Hark.
On *Artemisia biennis* and *Iva xanthiifolia*. Kulm, July, 1913. (Fungi Dak. *237*.)

Ophiobolus collapsus Ellis & Everh.
On *Chenopodium album* and *Lappula Lappula*. Kulm, July, 1913.

Ophiobolus porphyrogonus (Tode) Sacc.
On *Brassica arvensis*. Kulm, August, 1913.

Otthia Crataegi Fuckel.
On *Crataegus mollis*. Kulm, May, 1911.

Parodiella grammodes (Kuntze) Cooke.
On *Psoralea argophylla*. Williston, August, 1915.

Patellaria atrata (Hedw.) Sacc.
On *Prunus melanocarpa*. Wirch Lake, May, 1914.

Patellaria clavispora (Peck) Sacc.
On willow and cottonwood. Fargo, Seaver.

Peroneutypa corniculata (Ehrh.) Berl.
On *Prunus melanocarpa*. Wirch Lake, May, 1914.
(Fungi Dak. *250*.)

Peziza badia Pers.
On soil in woods. Fargo, 1907, Seaver.

Peziza repanda Wallr.
On log in woods. Fargo, 1908, Seaver.

Peziza rutilans Fries.
On moss sod. Kulm, September, 1911.

Peziza vesiculosa Bull.
On soil and manure. Kulm; Sykeston, Seaver.

Pezicula Rosae Sacc.
On *Rosa* sp. Kulm, January, 1914.
(Fungi Dak. *392*.)

Pezizella dakotensis Rehm, n. sp.
On *Symphoricarpos occidentalis*. Kulm, July, 1913.

Phacidium Trifolii (Barsch) Boud.
On *Trifolium pratense*. Grandin, June, 1915, Stevens.

Phaeopeziza fuscocarpa (Ellis & Holw.) Sacc.
On old wood. Fargo, August, 1908, Seaver.

Phialea cyathoides (Bull.) Rehm.
On *Iva xanthiifolia*. Kulm, July, 1913.

Phialea Urticae (Pers.) Sacc.
On *Urtica gracilis*. Fargo, Seaver.

Phomatospora Rosae Rehm, n. sp.
On *Rosa* sp. Kulm, July, 1913.
(Fungi Dak. *284*.)

Phyllachora canaliculata Sacc.
On *Cyperus Schweinitzii*. Anselm, August, 1916, Stevens.

Phyllachora graminis Pers.
On many grasses. Kulm, 1909.
(Fungi, Dak. *8*, *9*.)

Phyllachora Tracyi Ellis & Everh.
On *Distichlis spicata*. Kulm, August, 1908.
(Fungi Dak. *10*.)

Phyllactinia suffulta (Reb.) Sacc.
On *Fraxinus lanceolata*. Fargo, September, 1914, Stevens.
(Fungi Dak. *286*.)

Physalospora Festucae (Liebret) Niessl.
On *Agropyron tenerum*. Kulm, November, 1913.

Physalospora megastoma (Peck) Woron.
On *Astragalus bisulcatus* and *A. goniatus*. Kulm, June, 1910.
(Fungi Dak. *11*.) Not *P. aurantica* Ellis & Everh.)

Pleonectria berolinensis Sacc.
On *Ribis rubrum* and *R. floridum*. Kulm, July, 1909.
(Fungi Dak. *125, 239.*)

Pleosphaerulina corticola (Fuckel) f. *Rosae* Rehm.
On *Rosa* sp. Kulm, March, 1913.

Pleosphaerulina corticola (Fuckel) f. *Crataegi* Rehm.
On *Crataegus mollis*. Kulm, March, 1913.

Pleospora diaportheoides Ellis & Everh.
On *Helianthus Maximiliani*. Kulm, September, 1913.

Pleospora Lecanora (Falve) Rehm.
On *Salsola tragus*. Kulm, July, 1913.
(Fungi Dak. *240.*)

Pleospora permunda Cooke.
On *Urtica gracilis*. Kulm, September, 1913.

Pleospora vagans Niessl.
On *Poa serotina*. Kulm, August, 1913.

Pleospora vulgaris Niessl. f. *astericola* Rehm.
On *Aster multiflorus*. Kulm, July, 1913.

Plowrightia morbosa (Schw.) Sacc.
On *Prunus Bessii, P. americana* and *P. melanocarpa*.
(Fungi Dak. *97, 410.*)

Plowrightia Symphoricarpi Ellis & Everh.
On *Symphoricarpos occidentalis*. Kulm, April, 1909.

Podosphaera Oxyacanthae (DC.) DeBary.
On *Crataegus mollis*. Fargo, Stevens.
On *Prunus Bessii*, Dickenson, September, 1916.
On *Prunus americana* and *P. melanocarpa*.
(Fungi Dak. *146, 288.*)

Propolis faginea (Schrad.) Karst.
On old wood. Fargo, August, 1907, Seaver.

Pseudopeziza Medicaginis (Lib.) Sacc.
On *Medicago sativa*. Fargo, August, 1907, Seaver.

Pseudotthia Symphoricarpi (Ellis & Everh.) Rehm.
On *Symphoricarpos occidentale*. Kulm, February, 1913.
(Fungi Dak. *98.*) Syn. *Otthia Symphoricarpi* Ellis & Everh.

Pyrenopeziza Absinthii (Lasch.) Rehm.
On *Iva xanthiifolia*. Kulm, March, 1910.
(Fungi Dak. *215.*)

Saccobolus Kerverni (Crouan) Boud.
On cow dung. Sykeston, 1908, Seaver.

Saccobolus violascens Boud.
On horse dung. Sykeston, 1908, Seaver.

Sarcoscypha coccinea (Jacq). Cooke.
On wood. Fargo, 1907, Seaver.

Sarcoscypha occidentalis (Schw.) Cooke.
On old wood. Fargo, Seaver.

Schizoxylon Berkeleyanum (Dur. & Lev.) Fuckel.
On dead *Helianthus Maximiliani*. Kulm, April, 1913.

Schizoxylon compositum Ellis & Everh.
On *Prunus melanocarpa*. Kulm, May, 1914.

Schizoxylon decipiens Karst.
On *Apocynum hypericifolium*. Kulm, November, 1913.
(Fungi Dak. *264*.)

Schizoxylon decipiens Symphoricarpi Rehm.
On *Symphoricarpos occidentalis*. Kulm, April, 1909.

Schizoxylon insigne (DeNot.) Bres.
On *Crataegus mollis*. Kulm, March, 1913.
(Fungi Dak. *216*.)

Pyrenopeziza caricina (Lib.) Rehm.
On *Carex siccata*. Kulm, March, 1915.

Pyrenophora echinella (Cooke) Berl.
On *Dondia depressa*. Kulm, August, 1913.

Rhopographus clavisporus (Cooke & T.) Ellis.
On *Phragmites communis*. Kulm, October, 1915.

Pyronema omphalodes (Bull.) Fuckel.
On burned over soil. Sykeston, 1908, Seaver.

Rhytisma salicinum Fries.
On *Salix spp*. Kulm, August, 1908.
(Fungi Dak. *48*, *48*a.)

Rosellinia ovalis (Ellis) Sacc.
On *Chrysothamnus graveolens*. Sentinal Butte, August, 1914, Stevens.

Rosellinia pulveracea (Ehrh.) Sacc.
On various dead woods. Kulm, May, 1914.
(Fungi Dak. *99*.)

Rosellinia Rosarum (Niessl.) Rehm.
On *Rosa* sp. Kulm, May, 1913.

Rosenscheldia Heliopsidis (Schw.) Theis. & Syd.
Syn. *Bertiella Brenckleana* Rehm.
On *Aster multiflorus*. Kulm, March, 1910.
(Fungi Dak. *227*.)

Schizoxylon occidentalis. Ellis & Everh.
On *Fraxinus* and *Populus*. Kulm, June, 1913.

Scleroderris ribesia (Pers.) Karst.
On *Ribes floridum*. Kulm, May, 1913.
(Fungi Dak. *217*, *217*a.)

Sordaria amphisphaerioides Ellis & Everh.
On horse dung. Kulm, November, 1913.

Sphaerella Fragariae (Tul.) Sacc.
On *Fragaria* sp. Kulm, August, 1908.

Sphaerella juniperina Ellis.
On *Juniperus prostrata*. Glenn Ullin, July, 1915, Stevens.

Sphaerella Yuccae Ellis.
On *Yucca glauca*. Mandan, July, 1915, Stevens.

Sphaerotheca Castagnei Lév.
On *Bidens vulgata, Collomia linearis, Taraxacum officinale,* and *Hydrophyllum virginianum*. Kulm and Valley City, Seymour.
(Fungi Dak. *149, 168, 219.*)

Sphaerotheca Humuli (DC|) Burrel.
On *Agrimonia hirsuta* and *Viola canadensis*. Kulm, 1909.
On *Geum canadense*. Wild Rice. August, 1914, Stevens.
(Fungi Dak. *296, 399.*)

Sphaerotheca Humuli fuliginea (Schw.) Salmon.
On *Taraxacum officinale*. Fargo, August, 1907, Seaver.

Sphaerotheca mors-uvae (Schw.) Berk. & Curt.
On *Ribes floridum*. Kulm and Valley City, Seymour.

Sphaerotheca pannosa (Wallr.) Lév.
On *Rosa carolina*. Fargo, September, 1914, Stevens.
(Fungi Dak. *297.*)

Sphaerulina corticola (Fuckel) Rehm.
On *Rosa* sp. Kulm, October, 1914.

Sphaerulina divergens Rehm, n. sp.
On *Elymus canadensis*. Kulm, July, 1913.

Sphaerulina Salicis Syd., n. sp.
On *Salix longifolia*. Kulm, February, 1913.
(Fungi Dak. *220.*)

Teichospora aberrans Rehm, n. sp.
On *Salix* sp. Kulm, December, 1913.

Teichospora fulgarata Ellis & Everh.
On *Populus deltoides*. Kulm, September, 1914.
(Fungi Dak. *321.*)

Teichospora Helenae Ellis & Everh.
On *Salix* and *Populus*. Kulm, April, 1914.
(Fungi Dak. *322.*)

Teichospora gregaria Ellis & Everh.
On *Fraxinus lanceolata*. Kulm, June, 1913.

Teicospora Pruni-americanae Rehm, n. sp.
On *Prunus americana*. Kulm, July, 1913.

Teichospora solitaria (Ellis) Ellis & Everh.
On *Artemisia canadensis.* Glen Ullin, July, 1915, Stevens.

Thecotheus Pelletieri (Crouan) Boud.
On dung. Woods, Fargo, 1907, Seaver.

Thyridana Fraxini Ellis & Everh.
On *Fraxinus lanceolata.* Wirch Lake, May, 1914.

Trichopeziza sulphurea (Pers.) Fuckel.
On herbaceous stems. Fargo, Seaver.

Trichopeziza Tiliae (Peck) Fuckel.
On *Tilia americana.* Fargo, 1907, Seaver.

Uncinula Clintonii Peck.
On *Tilia americana.* Ft. Ransom, August, 1916, Stevens.
(Fungi Dak. *424.*)

Uncinula macropus Peck.
On *Ulmus americana.* Fargo, October, 1914, Stevens.
(Fungi Dak. *298.*)

Uncinula necator (Schw.)Burrill.
On *Parthenocissus quinquefolia.* Fargo, October, 1914, Stevens.
(Fungi Dak. *299.*)

Uncinula Salicis (DC.) Wint.
On *Salix cordata.* Fargo, October, 1914, Stevens.
(Fungi Dak. *222, 300.*)

Urnula craterium (Schw.) Fries.
On dead wood. Fargo, 1907, Seaver.

Valsa ambiens (Pers.) f. *Crataegi* Rehm.
On *Crataegus mollis.* Kulm, March, 1913.
(Fungi Dak. *323.*)

Valsa ambiens (Pers.) f. *Elaeagni* Rehm.
On *Elaeagnus argentea.* Kulm, 1914.
(Fungi Dak. *324.*)

Valsa ambiens (Pers.) f. *Rosae* Rehm.
On *Rosa heliophylla.* Kulm, February, 1913.
(Fungi Dak. *3325.*)

Valsa ambiens (Pers.) Fries.
Also on *Rubus strigosua, Shepherdia argentia,* and *Ulmus americana.* Kulm, October, 1916. Whether the forms on each of these hosts should be listed separately as Dr. Rehm would have it I do not know.

Valsa americana Berk & Curt.
On *Prunus americana.* Fargo, 1914.

Valsa cincta Peck.
On *Prunus melanocarpa.* Kulm, May, 1913.
(Fungi Dak. *223.*)

Valsa fraxinina Peck.
On *Fraxinus lanceolata*. Kulm, June, 1913.
(Fungi Dak. *249*.)

Valsa salicina (Pers.) Fries.
On *Salix*, various species. Kulm, March, 1913.
(Fungi Dak. *224*.)

Valsa salicina (Pers.) Fries f. *tetraspora* Fries.
On *Salix longifolia*. Kulm, March, 1913.
(Fungi Dak. *169*.)

Valsa sordida Nitsch.
On *Salix longifolia*. Kulm, March, 1913.

Valsa Symphoricarpi Rehm, n. sp.
On *Symphoricarpos occidentalis*. Kulm, March, 1909.
(Fungi Dak. *150*.)

Valsa translucens DeNot.
On *Salix longifolia*. Kulm, March, 1913.

Valsaria moroides Acerina Rehm.
On *Acer Negundo*. Kulm, June, 1913.
(Fungi Dak. *250*.)

Valsella nigroannulata Fuckel.
On *Salix longifolia*. Kulm, March, 1913.
(Fungi Dak. *225*.)

Xylaria filiformis (Albert & Schw.) Fries.
On twigs. Kulm, April, 1908.

Zignoella Roripae Rehm, n. sp.
On *Roripa* sp. Kulm, December, 1913.

KULM, NORTH DAKOTA.

CULTURES OF UREDINEAE IN 1916 AND 1917[1]

J. C. Arthur

The present article is the fifteenth in a series of reports[2] by the writer upon the culture of plant rusts, beginning in 1899 and completing nineteen consecutive years. The preparation of the index and summary to the series, as stated in the report for last year, has been delayed, but together with a general retrospect is expected to appear in a succeeding number of this journal. After this, if work of the present character is continued, it will be reported in some other form.

Field Observations in 1916

The writer, by the courtesy of the botanical department of the Indiana Agricultural Experiment Station now under the direction of Professor H. S. Jackson, was enabled to make important observations in the field during 1916, which have proved of the utmost value, not only in detecting the alternate form of certain heteroecious species, but in securing a more adequate conception of the different aspects and range of hosts of particular species when occurring under unlike conditions or in the midst of plant societies composed of different elements.

The first trip of the year was to State College, Pa., in the last days of April, where Dr. F. D. Kern and his associates in the botanical department of the Pennsylvania State College gave every facility for a week's field work. Two excursions in the vicinity are especially worthy of mention, both taken under the personal direction of Professor C. R. Orton. An over-mountain road took us to Charter Oak, where the locality for the amphi-

[1] Presented in part before the Botanical Society of America at the New York meeting, December 29, 1916.

[2] See Bot. Gaz. **29**: 268–276; **35**: 10–23; Jour. Myc. **8**: 51–56; **10**: 8–21; **11**: 50–67; **12**: 11–27; **13**: 189–205; **14**: 7–26; Mycol. **1**: 225–256; **2**: 213–240; **4**: 7–33, 49–65; **7**: 61–89; and **8**: 125–141.

sporic *Carex* rust, *Puccinia microsora* Körn., was searched for clues to the alternate host without much success. A twelve-mile ride in another direction to Bear Meadow, an extensive mountain bog, gave opportunity to study the occurrence of *P. uniporula,* and some other difficult *Carex* forms.

On May 13 a western trip of a little over three weeks was begun. The first stop was a few days given to the study of the rust flora of the semi-arid plains between Grant and Ogallala in western Nebraska, where the second telial host for *Puccinia universalis* to be proven by cultures was found.

Next came a few days (May 18–22) at Laramie, Wyo., altitude of 7,500 feet, where the season was not sufficiently advanced for the best field work, but where through the courtesy of Professor Aven Nelson and the assistance of Mr. Edwin Payson an examination of the extensive and valuable Rocky Mountain Herbarium yielded many new hosts and localities for numerous western rusts.

Interesting observations were made (May 23–24) in the vicinity of Ft. Collins, Colo., where every attention was extended by members of the biological staff of the Agricultural College. Professor W. W. Robbins undertook to continue the observation of a number of clumps of *Astragalus* and *Oxytropis* as the season advanced. These plants were growing with masses of aecia-bearing *Euphorbia robusta* intermixed. On October 24 Professor Robbins reported that no rust had appeared on any of the plants of *Astragalus* or *Oxytropis* under observation. From European studies it has seemed probable that the perennial aecia on upright *Euphorbias* and the *Uromyces punctatus* on *Astragalus* and allied hosts, both especially abundant in the Rocky Mountains, were alternating forms of the same rust, but so far neither repeated attempts at cultures nor field evidence have afforded any support to the assumption.

At Windsor, Colo., as the guest of Mr. Geo. E. Osterhout (May 25), a fine display of over-wintered *Puccinia Distichlidis* on *Spartina* was seen in the field with an abundant growth of *Stieronema ciliatum* nearby. Telial material from this locality subsequently gave successful cultures, and on June 12 Mr. Osterhout sent aecia on *Stieronema,* which he obtained from the spot

visited. This is the second culture and the second aecial field collection so far secured.

At Denver the writer was joined by Professor H. S. Jackson. While here (May 26–31) we were under the guidance of Mr. Ellsworth Bethel, whose extensive knowledge of the flora of Colorado and especially his very intimate familiarity with the rust flora of the foot hills and plains about Denver, together with his highly enthusiastic and generous disposition, made the days memorable for the number and important character of the observations. Beside excursions immediately about Denver longer trips were taken through the Municipal Mountain Parks, to Pueblo, and to Boulder, all but the last by automobile with observations along the way. The rust flora of this region is the richest and most varied known to the writer, and the visit resulted in a large increase in knowledge regarding new forms and combinations. The identity of *Puccinia Schedonnardi* with *P. Muhlenbergiae,* the status of *Aecidium Abroniae, Aecidium Liatridis* and the aecia on *Polygonum aviculare,* heretofore erroneously associated with *Uromyces Polygoni,* were established, and much else accomplished. A visit to Mr. Bethel's garden, in which he carries out large numbers of open-air cultures, was most instructive as well as indicative of the highly valuable character of his studies.

The final stop (June 1–2) of the journey was at Manhattan, Kans., where over thirty years ago Professor W. A. Kellerman brought to light a number of forms still imperfectly known. By the aid of Mr. L. E. Melchers and other members of the Agricultural College a fruitful reconnaissance of the vicinity was made, resulting especially in detection of the alternate form for the *Aecidium* on *Allium,* which had tentatively been assigned by different observers to no less than four very unlike telial forms.

Such excursions for observation as those just mentioned have been of inestimable value in securing knowledge for the successful prosecution of the culture work. Without numerous cultures the marvelous advance of recent years in the taxonomic study of American rusts would have been largely impossible. Moreover, without the most varied cultures brought about by observations in widely separated parts of the country the intricate

relationships, transcending all deductions derivable from morphological study alone, must have remained unrecognized, or in so far as dimly apprehended be wholly without demonstration.

A number of correspondents assisted in securing needed material for the season's work, and to them thanks are due. There were available 170 collections with resting spores, and 9 with active spores as in *Aecidium* and *Gymnosporangium*. Some 452 tests were made in a hanging drop to determine the germinating condition of the spores. Only 69 collections of resting teliospores could be brought to germination from which 182 sowings were made, and 17 infections secured. From the 9 collections of fresh spores 12 sowings were made, and 3 infections secured. The work was largely performed by Mr. C. C. Rees, a member of the regular staff of the laboratory.

NEGATIVE RESULTS IN 1916.—Of the various attempted cultures which failed to produce inoculations two are worthy of record.

1. UROMYCES GRAMINICOLA Burr. on *Panicum virgatum* L., sent by Mr. E. Bartholomew from Stockton, Kans., was sown April 25 on *Euphorbia corollata,* and again May 25 on the same host, in both instances with no apparent result. In previous seasons the same species was sown on a number of other hosts,[3] but in the meantime from morphological and distributional data the conclusion had been reached that this form is probably correlated with *Puccinia Pammelii* on the same host, whose aecia are known to be on *Euphorbia corollata.* Other attempts at cultures should be made before abandoning the assumption.

2. PUCCINIA on *Carex Backii* Boott (*C. durifolia* Bailey) obtained by Mr. E. Bethel in February from near Denver, Colo., was sown April 7 on *Ribes Cynosbati, Boltonia asteroides* and *Urtica gracilis,* and again May 15 on the same hosts and on *Eleagnus argentea* and *Artemisia dracunculoides.* The same form obtained by Mr. Bethel in March from Boulder, Colo., was sown April 7, on *R. Cynosbati, B. asteroides,* and *U. gracilis,* and April 15, on *R. Cynosbati, U. gracilis,* and *E. argentea.*

[3] See Jour. Myc. **12**: 13. 1906; Mycol. **1**: 232. 1909; **2**: 220. 1910; **4**: 12. 1912.

Another collection sent from Valentine, Neb., by Rev. J. M. Bates, was sown May 26, on *R. Cynosbati, B. asteroides, U. gracilis* and *E. argentea.* All the sowings were without effect. All three collections gave fairly strong germination of the teliospores at the date of sowing.

Cultures have been attempted once before[4] on five hosts, all but one different from the above. The morphological characters of this form approximate those of *Puccinia Grossulariae* on various species of *Carex,* but nothing has yet been proven by cultures.

SUCCESSFUL CULTURES IN 1916 SUPPLEMENTING PREVIOUS WORK.—The culture of the following seven species adds valuable information in each case to the facts previously recorded.

1. PUCCINIA UNIVERSALIS Arth.—Material on *Carex filifolia,* collected by the writer May 18, 1916, at Ogallala, Neb., was sown June 2, on *Artemisia gnaphalodes.* Pycnia were detected June 15, but doubtless appeared earlier, being obscured by the heavy tomentum of the plant, and were followed by a large number of aecia, first seen June 28. This rust has been cultivated a number of times before[5] on various species of *Artemisia,* but only with telial material from *Carex stenophylla. Carex filifolia,* like *C. stenophylla,* occurs on semi-arid plains. It usually grows only three or four inches high, and in dense mats. It is locally known as "nigger-wool" or "black-root," from the tough, tangled mass of fine, black roots, resisting decay for a year or two when turned up by the plow and exposed to weathering.

2. PUCCINIA POCULIFORMIS (Jacq.) Wettst.—This very common stem rust of grasses and grains was grown on *Berberis vulgaris* from two collections made by Mr. G. E. Osterhout, Windsor, Colo., on March 2, one from *Sporobolus cryptandrus,* sown April 23, showing pycnia May 6, but not developing aecia, and the other from *Elymus canadensis,* sown May 15, showing pycnia May 25 and aecia June 6. Another collection on *Agropyron Smithii* made by Mr. E. Bethel, in Denver, Colo., March

[4] Mycol. 2: 248. 1910.

[5] For previous cultures see Jour. Myc. 14: 21. 1908; Mycol. 2: 224. 1910; and 4: 16. 1912.

6, was sown on *Berberis vulgaris* on April 23, and began to show pycnia April 30, and aecia May 4.[6]

3. PUCCINIA RHAMNI (Pers.) Wettst.—A collection made by Mr. G. B. Posey in December, 1915, at Corvallis, Oregon, on *Agrostis* sp., was sown May 11, on *Rhamnus Purshiana,* and showed pycnia in fair numbers May 20, but made no further development, although the leaves remained healthy and in good growing condition for a considerable time.

4. PUCCINIA DISTICHLIDIS Ellis & Ev.—This rust was found May 24 by Mr. Geo. E. Osterhout and the writer in great abundance on over-wintered *Spartina Michauxiana* in a field at Windsor, Colo., and entirely unmixed with any other rust known to occur on the same host. The spores had not yet germinated. Large groups of *Steironema ciliatum* nearby, the supposed alternate host, were already six or eight inches high and free from infection. The teliospores were sown on *S. ciliatum* in the greenhouse at Lafayette on May 30, and gave a heavy infection, showing pycnia June 4, and numerous aecia June 10. This result confirms the work of 1915[7] and establishes the life cycle of the species beyond doubt. On June 12 Mr. Osterhout sent a fine collection of aecia on *S. ciliatum* from the place where the cultural material had been obtained, being the second field collection for the species, the previous one being made in North Dakota.

5. PUCCINIA MUHLENBERGIAE Arth. & Holw. (*P. Schedonnardi* K. & S.).—Telial material of this rust was found May 28 by Professor H. S. Jackson and Mr. E. Bethel, on *Muhlenbergia gracillima,* a low, tufted and fine leaved species growing on the arid plains near Pueblo, Colo., associated with *Malvastrum coccineum,* suspected of being an alternate host. A sowing was made on *M. coccineum* June 2, which gave pycnia June 18, and aecia June 25, both in strong development.

Telial material of *Puccinia Schedonnardi,* on *Schedonnardus paniculatus* was obtained by Mr. Bethel, Professor Jackson and the writer at Pueblo, Colo. After the preceding trial showed signs of success, a striking resemblance was noticed between the

[6] For previous cultures see Jour. Myc. **8**: 53. 1902; **11**: 57. 1905; **12**: 17. 1906; **13**: 198. 1907; **14**: 16. 1908; Mycol. **2**: 227. 1910; and **4**: 18. 1912.

[7] See Mycol. **8**: 136. 1916.

two grasses in size and habit of growth and also between the gross appearance of the rusts they bore. The resemblance was furthermore found to extend to the microscopic features of the rusts. This led to sowing the teliospores upon *M. coccineum,* which was done June 23, and resulted in production of pycnia June 30, and aecia July 11. Although not so strong development as in the preceding case the gross and microscopic appearances were the same, and left no doubt that *P. Schedonnardi* is to be considered synonymous with *P. Muhlenbergiae,* a species of many races and hosts.[8] The middle of September subsequent to these cultures a letter was received from Mr. E. Bartholomew, of Stockton, Kans., in which he gives the following account of observations, most strongly confirming the conclusion reached from cultures. He says: "Standing in the doorway of the Mt. Nebo Presbyterian Church, three and one half miles south of our home, on June 11, 1916, I noticed, very close to the building, a large number of plants of *Malvastrum coccineum* profusely attacked by *Aecidium malvicola* Arth., and on examining the grasses growing among the *Malvastrum* there was found teleuto material on dead *Schedonnardus,* and on the developing young leaves and sheaths abundant uredo of *Puccinia Schedonnardi!* Continued examinations for several weeks, as the *Puccinia* developed into the III, led me to conclude beyond a peradventure that the aecium is no more nor less than I of this fungus as the grass was infected only in the near reach (not to exceed one rod) of the *Malvastrum.* While I have collected this *Puccinia* several times in the past ten years I have not come across *Aecidium malvicola* since May, 1904 (F. Col. No. 1905)."

6. PUCCINIA SUBNITENS Diet.—This rust is probably the most remarkable known for the number and diversity of its aecial hosts. The present addition of two families to the aecial hosts as previously recorded is entirely the result of information supplied by Mr. E. Bethel, who had made repeated observations of propinquity in the field, and verified his assumptions of relationship by cultural tests in his garden in Denver.

Telial material on *Distichlis spicata* obtained by Professor H.

[8] For previous cultures see Jour. Myc. **11**: 51. 1905; **13**: 192. 1907; Mycol. **1**: 251. 1909; **2**: 226. 1910; **4**: 18. 1912; and **7**: 82. 1915.

S. Jackson at Denver, Colo., May 26, was sown June 9 on *Abronia fragrans* (family Nyctaginaceae) and *Polygonum aviculare,* with infection only on the *Abronia,* on which pycnia began to appear June 15, and aecia June 19, in abundance. A collection on the same host made by the writer at Ft. Collins, Colo., May 23, was sown on *Polygonum aviculare* (family Polygonaceae) June 23, giving pycnia June 30, and aecia July 3, showing strong development.[9]

7. PUCCINIA LIATRIDIS (Ellis & And.) Bethel.—After repeated assurances from Mr. E. Bethel that he had found a rust on *Koeleria cristata* that would produce aecia on *Liatris,* and had cultured it in his garden, and having received material for study, successful sowings were made fully confirming his contention. A telial collection made by Mr. Bethel April 22, at Boulder, Colo., was sown May 4, on *Laciniaria punctata* (*Liatris punctata*), showing pycnia May 15, and aecia May 22. Another collection made by Mr. Bethel and the writer May 30, at Boulder, Colo., was sown on *L. punctata* June 23, showing pycnia July 3, and aecia July 7. The aecia have long passed under the name of *Aecidium Liatridis* Ellis & And., but the telial form has only recently been separated from the several other rusts on *Koeleria* in a paper by Bethel, in which he gives an account of his cultures, but which has not yet been received by the writer in printed form.

SUCCESSFUL CULTURES IN 1916 REPORTED NOW FOR THE FIRST TIME.—The following species have never been cultivated in America or elsewhere, so far as the writer knows.

1. UROMYCES SPOROBOLI Ellis & Ev. (*Aecidium alliicolum* Wint.).—On June 1 the writer in company with Messrs. L. E. Melchers, G. W. Putnam and H. S. Jackson explored a number of centers of infection of *Allium stellatum* showing aecia, found in great abundance in a field adjoining the campus of the Agricultural College at Manhattan, Kans. In one place a few uredinia were found on seedling grass about three inches high, ascertained to be *Sporobolus vaginaeflorus,* while over-wintered telia were

[9] For previous cultures see Bot. Gaz. **35**: 19. 1903; Jour. Myc. **11**: 54. 1905; **12**: 16. 1906; **13**: 197. 1907; **14**: 15. 1908; Mycol. **1**: 234. 1909; **2**: 225. 1910; **4**: 18, 54. 1912; and **8**: 135. 1916.

found on the dead plants of the same annual grass, all pointing to a genetic connection. Hard clumps of earth with the young grass were taken at some distance from the aecial areas and brought to the greenhouse at Lafayette. Whole plants of the *Allium,* in size and appearance much resembling the garden onion, on which were abundant aecia, were also taken, and on June 6 a sowing was made on the seedling grass, resulting in uredinia, first noticed June 21. Another lot of *Allium* plants from the same field, bearing aecia, was sent by Mr. Melchers about two weeks later, and another sowing made June 22, giving uredinia June 29. Neither cultures developed telia, owing to the difficulty in keeping the grass growing properly in the greenhouse. No uredinia appeared on any of the grass not used for inoculation.

The first cultural attempt with the telia of this rust was made fourteen years ago,[10] and again in 1910 and 1912, many hosts being used.[11] In 1912 the attempt was made to follow up observations by Mr. E. Bartholomew at Stockton, Kans., by sowing on *Allium reticulatum,* among other hosts, but with no success. Again this year Mr. Bartholomew sent telia on *Sporobolus neglectus,* which were sown on *A. reticulatum* and *A. canadense,* but again without success. No reason can be assigned for the failures.

2. PUCCINIA VERNONIAE B. & C.—A collection of this rust on dead stems of some undetermined species of *Vernonia,* obtained by Mr. C. H. Crabill at Cliffview, Va., March 9, was forwarded by Dr. F. D. Fromme. The sori were numerous and large, ranging from 0.5 to 1.5 cm. long. A sowing was made on the leaves of an undetermined species of *Vernonia,* which resulted in an abundance of pycnia, and some uredinia, but growth ceased before telia were formed. Exact dates were not secured, but the sowing was made about April 30, and the leaves removed for the herbarium on July 6, bearing pycnia and uredinia. This is the first record for pycnia of this very common rust. The life cycle shows that the species belongs in the genus *Bullaria,* in which it becomes **Bullaria Vernoniae** (B. & C.) comb. nov.

[10] Bot. Gaz. **35**: 11. 1903.

[11] See Mycol. **4**: 13. 1912; and **7**: 66. 1915.

SUMMARY FOR 1916

The following is a complete list of the successful cultures made during the year 1916. Those of the first series are species which have been previously cultured, but those of the second list have never been reported before.

A. SPECIES PREVIOUSLY REPORTED

1. PUCCINIA UNIVERSALIS Arth. Teliospores from *Carex filifolia* Nutt., sown on *Artemisia gnaphalodes* Nutt.

2. PUCCINIA POCULIFORMIS (Jacq.) Wettst.—Teliospores from *Sporobolus cryptandrus* (Torr.) A. Gray, *Agropyron Smithii* Rydb. and *Elymus canadensis* L., sown on *Berberis vulgaris* L.

3. PUCCINIA RHAMNI (Pers.) Wettst.—Teliospores from *Agrostis* sp., sown on *Rhamnus Purshiana* DC.

4. PUCCINIA DISTICHLIDIS Ellis & Ev.—Teliospores from *Spartina Michauxiana* Hitchc., sown on *Steironema ciliatum* (L.) Raf.

5. PUCCINIA MUHLENBERGIAE A. & H. (*P. Schedonnardi* Kellerm. & Sw.).—Teliospores from *Muhlenbergia gracillima* Torr., and from *Schedonnardus paniculatus* (Nutt.) Trel., sown on *Malvastrum coccineum* (Pursh) A. Gray.

6. PUCCINIA SUBNITENS Diet.—Teliospores from *Distichlis spicata* (L.) Greene, sown on *Abronia fragrans* Nutt., and *Polygonum aviculare* L.

7. PUCCINIA LIATRIDIS (Ellis & And.) Bethel.—Teliospores from *Koeleria cristata* (L.) Pers., sown on *Laciniaria punctata* (Hook.) Kuntze.

B. SPECIES REPORTED NOW FOR THE FIRST TIME

1. UROMYCES SPOROBOLI Ellis & Ev. (*Aecidium alliicolum* Wint.).—Aeciospores from *Allium stellatum* Ker., sown on *Sporobolus vaginaeflorus* Torr.

2. PUCCINIA VERNONIAE B. & C.—Teliospores from *Vernonia* sp., sown on the same host.

CULTURES IN 1917

No trips for observation were taken during this year, and the usual amount of time bestowed on the cultures was greatly reduced. About 25 collections with resting spores and 6 with active spores, the latter all forms of *Aecidium*, were available for the tests. About 120 drop cultures were made from the sets of resting spores, showing that 15 of the collections were more or less viable at the time. From the fifteen collections 14 successful inoculations were secured, 103 sowings having been made. The work was partly done by Mr. C. C. Rees and partly by Dr. E. B. Mains, members of the laboratory staff.

NEGATIVE RESULTS IN 1917.—It seems worth while to call attention to three attempts which wholly failed, with the hope that some one may be aided in solving the problems involved.

1. PUCCINIA TRITICINA Erikss. on *Triticum vulgare* Mill. was obtained from the border of a wheat field in September, 1916, by Mr. C. C. Rees, and sown on *Clematis Flammula* L., May 17 following, but with no result. The teliospores, however, were germinating very feebly. The conclusion was reached some two years ago from morphological and other data, that the common leaf rust of wheat is a race of the common *P. Agropyri* E. & E., occurring upon many wild grasses. *P. Agropyri* from *Agropyron glaucum* was cultured on *Clematis Vitalba* L. in Germany by Dietel in 1892. In America cultures have shown races to exist in eastern United States between *Bromus ciliatus* and *Clematis virginiana*, in Colorado between *Elymus canadensis* and *Agropyron Smithii* and *C. ligusticifolia*, in Texas between *Elymus virginicus* and *C. Drummondii*, and in North Dakota between *E. canadensis* and *Anemone cylindrica*. As *Clematis Flammula* and *C. Vitalba* are almost the only common Ranunculaceous plants through the wheat growing regions of southern Europe, northern Africa and western Asia, an area that probably includes the home of the original wild wheat, the assumption is reached that one or both these hosts can be made to bear aecia from *P. triticina* under favorable conditions.

2. PUCCINIA EMACULATA Schw. on *Panicum capillare* L. was sown May 8 on *Euphorbia corollata*, and May 9 on *E. commutata*

with no infection, from material obtained by Prof. H. S. Jackson in southern Indiana. Another collection secured by Dr. E. B. Mains at Lafayette, Ind., was sown May 17 on *E. corollata*, and again May 24, June 5 and 13, on *E. Ipecacuanhae*, with no infection. In each case the teliospores showed fair germination and the hosts were in excellent condition. Judging from morphological and host data these species of *Euphorbia* would be probable aecial hosts, but all attempts at cultures[12] have so far failed. I am indebted to Prof. J. B. S. Norton, botanist of the Maryland Agricultural Experiment Station, for a number of serviceable plants of *E. Ipecacuanhae*.

3. PUCCINIASTRUM HYDRANGEAE (B. & C.) Arth., on *Hydrangea arborescens* L., collected by Dr. E. B. Mains at Lafayette, Ind., March 31, 1917, was sown May 12 on *Tsuga canadensis*, *Abies balsamea*, *Abies concolor*, and *Picea canadensis*, with no infection. Although no clues had been obtained from field observation, yet these genera of hosts include all on which any species of *Pucciniastrum* has yet been grown, and the teliospores were germinating freely, so there had been reasonable hopes of success.

SUCCESSFUL CULTURES IN 1917 SUPPLEMENTING PREVIOUS WORK.—The successful attempts to connect the aecia on *Iris versicolor* and on *Rudbeckia laciniata* with telial forms are the culmination of efforts extending over several years, in which a number of persons have aided. Similar efforts to connect the localized aecia on *Houstonia caerulea* and on *Capnoides montanum* have so far been without success, that is, for this laboratory.

1. PUCCINIA MAJANTHAE (Schum.) Arth.—This year for the first time American material of this widely distributed and highly specialized rust has been cultured. The work was first done by Prof. H. H. Whetzel at Ithaca, N. Y., in verification of observations at North Spencer, N. Y., made during the season of 1916 by Prof. Whetzel and Prof. H. S. Jackson. The account of the work has not been published at the time of this writing. Both before and after Prof. Whetzel had obtained his results he sent

[12] For previous attempts see Bot. Gaz. **35**: 12. 1903; Jour. Myc. **8**: 52. 1902; **10**: 10. 1904; **12**: 12. 1906; **13**: 192. 1907; **14**: 11. 1908; Mycol. **1**: 230. 1909; **7**: 65. 1915; and **8**: 127. 1916.

material and gave all possible aid in duplication of his work here in Indiana.

The teliospores from *Phalaris arundinacea*, obtained by Prof. Whetzel at North Spencer, N. Y., Nov. 6, 1916, were sown May 16 on *Iris versicolor*, and again May 17 on *I. versicolor*, and also on *Polygonatum commutatum*, *Vagnera racemosa*, *Convallaric majalis* and *Allium stellatum*. On May 19 they were sown on *Polygonatum biflorum* and May 20 on *Maianthemum canadense*. Only infection took place on *Iris*, the first sowing showing copious pycnia on May 21 and aecia on May 30, while the second sowing gave pycnia May 23 and aecia June 1. The only previous similar attempt was made in the cultures for 1910[13] when telial material from South Dakota was sown on *Polygonatum commutatum*, *Vagnera stellata*, *Convallaria majalis*, *Uvularia grandiflora* and *Trillium cernuum* with no infection. It is likely that *Puccinia Majanthae* has aecia on all the hosts named, but if so the occurrence of strongly pronounced biological strains prevented infection in the two tests.

2. PUCCINIA SUBNITENS Diet.—For a number of years the aecia on *Capnoides* (*Corydalis*) known as *Aecidium fumariacearum* Kellerm. & Sw., have been associated with the telia on *Distichlis spicata* from morphological and host considerations, but the cultures were not made until the present season, although several times attempted. In June Mr. E. Bethel sent aecia on *C. montanum* grown in his garden from teliospores on *D. spicata* secured at Berkeley near Denver, Colo.

Some of the same collection of telia was transmitted by Mr. Bethel and on June 14 the teliospores were sown on *Abronia fragrans*, *Capnoides montanum* and *Chenopodium album*, with infection only on the last host, giving pycnia June 21, and aecia June 23. Another sowing was made June 21 on *C. montanum*, but gave no infection. Possibly the lateness of season prevented success with the *Capnoides* although the more susceptible *Chenopodium* was infected.

3. UROMYCES SEDITIOSUS Kern.—Observations were made by Dr. F. D. Fromme and the writer in 1914 at Houston, Texas, which appeared to show that this rust sometimes forms aecia on

[13] Mycol. 4: 11. 1912.

Houstonia caerulea, and since then efforts have been made to secure suitable material with which to make tests. With this in view teliospores from a collection on *Aristida ramosissima* made by Prof. H. S. Jackson at Elberfield, Ind., were sown on *H. caerulea,* but without result. Again teliospores from a collection made by Prof. C. D. Learn on *A. basiramea* at Stillwater, Okla., were sown May 24 on *H. caerulea, Plantago Rugelii, P. lanceolata* and *P. aristata,* with infection only on the last two hosts, giving pycnia June 4 and aecia June 7, both in abundance.[14]

4. UROMYCES PERIGYNIUS Halst.—Aecia have been collected on *Rudbeckia laciniata* in the central west from Montana to Wisconsin, Nebraska and Indiana for which telial connection has been sought for some time.[15] Field observations made by Prof. E. W. D. Holway at Excelsior near Minneapolis, Minn., during 1916, pointed definitely to telia on a *Carex.* The material sent by Prof. Holway was *U. perigynius* on *C. sparganioides,* and was sown May 17 on *Solidago canadensis, Aster lateriflorus* and *Rudbeckia laciniata,* with exceedingly abundant infection on the last host, showing pycnia May 21 and aecia May 29. The *Solidago* and *Aster* remained free of rust. Evidently *Rudbeckia* acts as a racial host for this rust parallel with *Aster* and *Solidago.*

SUCCESSFUL CULTURES IN 1917 REPORTED NOW FOR THE FIRST TIME.—Both of the following species introduce questions of relationship which it is impossible at the present time fully to answer.

1. PUCCINIA SPOROBOLI Arth.—Observations were made by Dr. J. F. Brenckle at Kulm, N. Dak., which pointed distinctly to the connection of this rust with aecia on *Lilium umbellatum,* and material consisting of telia on *Sporobolus heterolepis* and bulbs of *L. umbellatum* were sent in the fall of 1916, with which to test the matter. Further telial material was sent the following spring. A sowing was made April 26 and again April 30 and May 1 on a garden lily, *L. elegans* Thunb., closely resembling *L. umbellatum,* the Dakotan plant not being in leaf, but with no infection. On May 16 two sowings were made on the same host and also on

[14] For previous cultures on Plantago see Bot. Gaz. **35**: 17. 1903.

[15] For unsuccessful tests see Jour. Myc. **12**: 12, 13, 14, 25. 1906; **13**: 191, 192, 202. 1907; Mycol. **1**: 229, 230, 251. 1909; **2**: 218. 1910; **4**: 9, 12, 13, 28. 1912.

L. umbellatum, with no infection on the first, and with abundant infection on the latter, showing pycnia May 23 and aecia May 29. Another sowing was made May 29 on *Vagnera stellata, Uvularia grandiflora, Maianthemum canadense, Allium stellatum,* all with no infection, and also on *A. Nuttallii* giving pycnia June 4, and aecia June 9, and on *A. cernuum* giving pycnia June 9, and aecia June 12, both in abundance. Sowings June 5 on *A. stellatum* and *A. canadense* gave no result.

Although the host of this rust is one of the principal prairie grasses of the western plains, yet the rust has been collected only in three localities, one at Decorah, Iowa, in 1884, 1901 and 1902, one at Ewing, northwestern Nebraska, in 1899, and the third a recent find at Kulm, N. Dak. It differs from all other American grass rusts in having the pores of the urediniospores near the hilum.

Last year *Uromyces Sporoboli* E. & E. on *Sporobolus vaginaeflorus* was connected with aecia on *Allium* from Kansas material. The aecia from the two species seem to be indistinguishable by any technical character. The suggestion at once arises that the two forms may be genetically correlated. Examination of the telia supports this hypothesis, for the mesosporic teliospores of the *Puccinia* are indistinguishable in size and appearance from the teliopores of the *Uromyces,* but on the other hand the urediniospores of the *Puccinia* are considerably smaller than those of the *Uromyces* and somewhat thinner walled. The greatest difference, however, lies in the arrangement of pores of the urediniospores. In the *Puccinia* they are three or four and basal, while in the *Uromyces* they are four and equatorial.

A particularly close correlation appears to exist between *Puccinia Cryptandri* E. & B. on *Sporobolus cryptandrus* and *U. Sporoboli,* both in uredinia and telia, although the urediniospores of P. *Cryptandri* are inclined to assume a winter resting condition with thicker walls. Unfortunately no suitable culture of *P. Cryptandri* has yet been made, and the aecia are unknown, but it may be assumed that they will be found to occur on *Allium* or a closely related host.

Putting together what is now known regarding these three forms of rust on *Sporobolus* and comparing with what is known of the

forms of rust on *Carex* going to Ribes, *P. Grossulariae* (Schum.) Lagerh. (*P. uniporula* Orton),[16] we seem justified in assuming that the grass forms in question represent one species made up of morphologico-physiological races, just as the sedge forms appear to do, but the proof is not so complete. The marked differences in the urediniospores of *P. Sporoboli, P. Cryptandri* and *U. Sporoboli,* are all such as can be harmonized with the assumption that the three forms represent only the races of one species, although it does not seem necessary now to go into the required explanation to make the matter perfectly clear. However, for convenient taxonomic reference, and until the relationship is more firmly established, it will be best to treat *P. Sporoboli, P. Cryptandri* and *U. Sporoboli* as independent species.

2. UROMYCES ON SPARTINA.—Field observations by Dr. J. F. Brenckle were made during the spring of 1915 at Kulm, N. Dak., which seemed to indicate connection between aecia on *Vagnera stellata* and the common *Uromyces* on *Spartina.* Such a connection seemed to be strengthened by later observations. On May 31, 1916, Dr. Brenckle says in a letter to the author: "Yesterday I went over my station carefully and found the infected plants of *Smilacina* [*Vagnera*] invariably accompanied by rusted *Spartina.* I noted also a number of well infected leaves, each of which was overhung and scraped on by a rusted leaf of *Spartina.* As the infection of *Smilacina* is only in the pycnial state it probably has not spread away from its original telial source. The *Smilacina* is abundant but the infected plants are sharply confined to those patches also inhabited by the *Spartina.* One such patch had plants of *Smilacina* which were *not* infected. I was disappointed that my theory was not proving correct until I noticed that the *Spartina had no rust.*"

With such strong circumstantial evidence the success of cultures undertaken with telial material supplied by Dr. Brenckle still came as a surprise, for three or four races of the *Uromyces* on *Spartina* are already well known having aecia on three families of dicotyledonous hosts, and no heteroecious rust has heretofore been discovered having aecia on both monocots and dicots.

On May 11 teliospores from *Spartina Michauxiana* were sown

[16] Mycol. 4: 13. 1912; 7: 66, 78. 1915.

on *Vagnera* (*Smilacina*) *stellata*, *Polygonatum biflorum* and *Steironema ciliatum*, with infection only on the first two, giving pycnia May 18, and aecia May 25, both in the greatest abundance and vigor. Another sowing was made May 19 on *Polygonatum biflorum*, showing pycnia May 28 and aecia June 7, also on *P. commutatum*, showing pycnia May 27 and aecia June 6, and furthermore on the following which were not infected: *Uvularia grandiflora*, *Maianthemum canadense*, *Vagnera racemosa*, *Iris versicolor* and *Trillium recurvatum*. Still another sowing was made May 23 on *Steironema lanceolatum* without infection, and May 29 on *U. grandiflora*, *M. canadense*, *V. racemosa* and *V. stellata*, with infection only on the last, only pycnia showing June 6, doubtless owing to the lateness of the season.

Upon studying the microscopic characters of the material here recorded the form is seen to readily fall into the species given in the North American Flora (7: 231) as *Nigredo Polemonii* (Peck) Arth. The aeciospores on *Vagnera* and *Polygonatum* are much larger (18–29 by 19–35 μ) than those on the same hosts which have been assigned to *Puccinia Majanthae* (Schum.) Arth. (15–21 by 16–27 μ), and have thicker walls, being characters by which the two species may be separated. A collection on *Vagnera stellata* from the valley of the Teton in northern Montana was some years ago made a new species under the name of *Aecidium magnatum* Arth., on these same characters. The aeciospores are somewhat larger than those on the other races of the *Uromyces* on *Spartina*, although there is a gradation in size within certain limits for the four races. In fact the four races of this species exhibit not only physiological specialization, but a certain amount of morphological differentiation of both aecia and telia, together with considerable geographical segregation.

For convenience in discussion of these races there would be some advantage to have distinctive names. The following outline will fairly well show the present morphologico-physiological divisions with geographical distribution, and corresponding names.

UROMYCES POLEMONII (Peck) Barth. (*Nigredo Polemonii* Arth.)

Aeciospores 14–19 by 15–23 μ, on *Caryophyllaceae*.
Teliospores generally broad and rounded above.

I. Salt marshes of coast, Nova Scotia (III also in Delaware and Florida), and Southern California (III not known on Pacific coast).....*Uromyces Spartinae* Farl.

Aeciospores 15–23 by 16–26 μ, on *Polemoniaceae.*

Teliospores narrow and mostly acuminate above.

I. Dry plains and thickets, Indiana and Wisconsin to North Dakota and foothills of Colorado (III same).

Uromyces acuminatus Arth.

Aeciospores 16–23 by 18–29 μ, on *Primulaceae.*

Teliospores mostly blunt or truncated above.

I. Moist plains, Central Indiana to Central Wisconsin and foothills of Colorado and Wyoming (III same).

Uromyces Steironematis nom. nov.

Aeciospores 18–30 by 19–35 μ, on *Convallariaceae.*

Teliospores generally blunt or acute.

I. Lake or river banks, Buffalo, N. Y., to Central Montana and Nebraska (III North Dakota)..**Uromyces magnatus** comb. nov.

The collection used for the initial culture may be taken as type of *U. Steironematis.* It was collected at Palmer, Neb., March 22, 1905, on *Spartina Michauxiana* Hitchc., by Rev. J. M. Bates, and was successfully sown May 26, 1905, on *Steironema ciliatum.*[17]

The forms of the teliospores and the habitats of the four forms are to be taken only as the general expression of the races, and are of no real diagnostic value except as associated with other characters. Both acuminate and rounded teliospores can usually be found in the same sorus, but the impression given by a microscopic mount from specimens of the first race is generally that the spores are prevailingly rounded above, from the second race, acuminate, etc.

The aecia of *U. Spartinae* have been collected on *Arenaria* and *Tissa* in Nova Scotia and southern California; those of *U. acuminatus* on *Collomia, Gilia, Phlox* (three species) and *Polemonium,* in Colorado, Indiana, Iowa, Minnesota, Nebraska, North Dakota, South Dakota and Wisconsin; those of *U. Steironematis* on *Dodecatheon* and *Steironema,* in Colorado, Illinois, Iowa, Kansas, Nebraska, North Dakota, South Dakota, Wisconsin and Wyoming; and those of *U. magnatus* on *Polygonatum* (two species) and *Vagnera* (two species), in Illinois, Iowa, Minnesota, Montana, Nebraska, North Dakota, South Dakota and Wisconsin.

[17] Jour. Myc. 12: 25. 1906.

Exsiccati material representing aecia has been issued as follows: for *U. Spartinae* none; for *U. acuminatus*, Barth. F. Columb. *2605*, Barth. N. Am. Ured. *597*, Brenckle, F. Dak. *102*, Ellis, N. Am. F. *1008*, Rab.-Wint. F. Eur. *3637;* for *U. Steironematis*, Barth. F. Columb. *2288*, Brenckle, F. Dak. *134, 259*, Ellis, N. Am. F. *1424*, Sydow, Ured. *2401;* and for *U. magnatus*, Barth. F. Columb. *4162, 4467, 4764*, Barth. N. Am. Ured. *661, 1074, 1170, 1269*, Brenckle, F. Dak. *1, 226*, Griff. West Am. F. *243*, Sydow, Ured. *2298*.

SUMMARY FOR 1917

A. SPECIES PREVIOUSLY REPORTED

1. PUCCINIA MAJANTHAE (Schum.) Arth.—Teliospores from *Phalaris arundinacea* L., sown on *Iris versicolor* L.

2. PUCCINIA SUBNITENS Diet.—Teliospores from *Distichlis spicata* (L.) Greene, sown on *Chenopodium album* L.

3. UROMYCES SEDITIOSUS Kern.—Teliospores from *Aristida basiramea* Engelm. sown on *Plantago aristata* Michx. and *P. lanceolata* L.

4. UROMYCES PERIGYNIUS Halst.—Teliospores from *Carex sparganioides* Muhl., sown on *Rudbeckia laciniata* L.

B. SPECIES REPORTED NOW FOR THE FIRST TIME

1. PUCCINIA SPOROBOLI Arth.—Teliospores from *Sporobolus heterolepis* A. Gray, sown on *Allium cernuum* Roth., *A. Nuttallii* S. Wats., and *Lilium umbellatum* Pursh.

2. UROMYCES MAGNATUS Arth.—Teliospores from *Spartina Michauxiana* Hitchc., sown on *Polygonatum biflorum* (Walt.) Ell., *P. commutatum* (R. & S.) Dietr., and *Vagnera stellata* (L.) Morong.

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THE PECK TESTIMONIAL EXHIBIT OF MUSHROOM MODELS

HOMER D. HOUSE

It is peculiarly fitting at his time to describe rather briefly the exhibit of mushroom models, recently installed in the State Museum at Albany, New York, as a memorial to the life and service of the late Charles Horton Peck, state botanist of New York from 1867 to 1915, a period of 48 years, of which all but the last two years were spent in active service.

The final installation of these remarkable mushroom models was completed only a few days prior to his death, which occurred on July 10, 1917. The models, fifty-seven in number and representing fifty-five species of edible and poisonous mushrooms, are the work of Mr. Henri Marchand, an artist and sculptor of rare ability. The models are made of wax from casts in the field and reproduce, with perfect fidelity to nature, the form, coloring, and habitat of each species.

Space need not be taken to enumerate the entire list of species which are represented in the collection, which includes:

POISONOUS

Amanita phalloides
Amanita muscaria
Clitocybe illudens
Russula emetica
Inocybe asterospora

EDIBLE OR HARMLESS

Amanita caesarea
Tricholoma sejunctum
Tricholoma personatum
Russula cyanoxantha
Russula virescens
Lepiota procera
Lepiota naucina
Agaricus campester
Agaricus arvensis
Coprinus comatus
Morchella deliciosa
Gyromitra esculenta
Strobilomyces strobilaceus
Pleurotus ostreatus
Fistulina hepatica
Armillaria mellea
Boletus cyanescens
Polyporus sulphureus

The services rendered by Doctor Peck in the field of mycology are surpassed by no other American student of fungi. His work, although not confined to the fleshy fungi, is best known from the hundreds of species which he has described in the fleshy and woody groups of fungi (Agaricaceae, Boletaceae, Hydnaceae, and Clavariaceae).

Without the advantages of European travel and study, and frequently working without access to the older European literature upon fungi, his work stands out with conspicuous individuality. That he has apparently described, in some cases, species already described by the older mycologists of Europe is no reflection upon his remarkable ability in the discernment of specific and generic characters of our native species.

His work will stand for all time as the foundation upon which later students of the fungi may build with safety a more elaborate morphological and systematic revision of the fleshy and woody groups of fungi.

Those friends, admirers, and fellow botanists who have contributed toward bringing into existence this testimonial exhibit of mushroom models, may well feel that there is no more suitable memorial possible. There are few pages of modern literature dealing with the fleshy and woody fungi that do not reflect in some degree the individuality of Doctor Peck's work, and looking at these models in the State Museum, with their exquisite variety of form and color, one may imagine with what pleasure and appreciation they would be viewed by him whom they memorialize.

EDUCATION BUILDING,
ALBANY, NEW YORK.

NOTES AND BRIEF ARTICLES

Professor W. T. Horne, of the State University of California, spent about six weeks at the Garden this summer after his return from Cuba, investigating the cytology and morphology of *Armillaria mellea*.

In an article in *Phytopathology* for February, A. S. Rhoads gives new hosts for a number of our common wood-destroying fungi and urges collectors to use more care in determining and listing the hosts of this class of fungi.

Sandy sporophores of *Fomes pinicola* are described and figured by A. A. Hansen in *Torreya* for April. The sporophores grew on an old log of *Pinus resinosa* found on the shore of Lake Superior.

D. C. Babcock, in a bulletin of the Ohio Experiment Station, gives popular descriptions and suggestions for control of a number of common diseases of forest and shade trees found in Ohio.

It is said that rose leaf-blotch, caused by *Actinonema Rosae*, may be prevented by repeated spraying with lime-sulphur solution, beginning before the buds open in the spring and repeating at intervals of ten days throughout the growing season, except when the roses are in bloom.

The gladiolus is subject to a hard-rot disease due to *Septoria Gladioli*, which affects both the leaves and the corms. Crop rotation and the burning of affected leaves in the autumn are suggested by L. M. Massey as means of partial control.

Professor John Dearness, of London, Canada, has been studying fresh specimens of *Clitopilus irregularis* Peck, a species described from his locality, and finds nothing to distinguish it from *Lepista tarda* (Peck) Murrill.

Professor H. L. Wells, of Yale University, collected a specimen of *Morchella crassipes* at New Haven in June which was about a foot high with a stipe as large as a man's arm. It was preserved in formalin and deposited at the Connecticut Agricultural Experiment Station.

The February number of *The Botanical Magazine*, published at Tokio, Japan, contains an article by Professor A. Yasuda on the Thelephoraceae, Hydnaceae, and Polyporaceae of Japan. Each number of this magazine has notes on fungi contributed by Professor Yasuda.

N. A. Naumov has made an extensive study of "intoxicating bread" and states that this disease of cereals is due to *Fusarium roseum* and *F. subulatum*. The mycelium will retain its vitality in infected grain stored under ordinary conditions for about three years, but is killed in a day by dry heat at 60° C.

A. A. Jaczewski describes about thirty fungous and bacterial diseases affecting the clover plant in Russia, two of them, *Fusarium Trifolii* and *Oedocephalum anthophilum*, being new. The latter causes a mold of the blossoms such as is seen in some roses, especially in the "Soleil d'Or."

The *Proceedings of the Indiana Academy of Sciences* for 1914 contains an article by C. E. O'Neal on some species of *Nummularia* common in Indiana; and one by G. B. Ramsey on the species of *Rosellinia* in Indiana, with a brief account of the 8 species of this genus said to be parasitic.

Bulletin 380 of the United States Department of Agriculture, by C. L. Shear and others, discusses the taxonomy, morphology, and physiology of the chestnut canker fungus and related species. It is stated that the fungus causing the chestnut canker is actively parasitic only on the chestnut, but occurs also on maple, hickory, oak, and sumac.

The *American Journal of Botany* for April contains a valuable illustrated article by A. W. Blizzard on the development of some species of agarics. The species investigated are: *Omphalia chrysophylla, Clitocybe adirondackensis, Clitocybe cerussata,* and *Clitopilus noveboracensis.*

In connection with the series of articles on Japanese fungi now appearing in *Mycologia,* it may be said that Dr. Tanaka always translates the explanation of the figures and in case some mycologist should wish to study the illustrations in the original Japanese article he would be glad to furnish him with a typewritten copy of the translation of the explanation of the figures.

Dr. Charles Horton Peck, former state botanist of New York, died at his home in Albany on July 11. Dr. Peck's official term of scientific service began in 1867, and extended over a period of forty-six years. He retired on account of illness and age in 1913, and at the time of his death was in his eighty-fifth year.

Dr. John A. Elliott, associate plant pathologist of the Delaware College Experiment Station, has been elected plant pathologist of the Arkansas Agricultural Experiment Station, to fill the vacancy created by the resignation of Professor J. Lee Hewitt, who has become secretary and chief inspector of the Arkansas State Plant Board.

Charles Fuller Baker, professor of agronomy in the college of agriculture of the University of the Philippines, has been

given a year's leave of absence, to accept under temporary appointment the post of assistant director of the Botanical Gardens at Singapore, in charge of experimental work in tropical agronomy.

Dr. L. H. Pennington, of the college of forestry of Syracuse University, has been put in charge of the white-pine blister rust survey for the State of Michigan, as the representative of the Bureau of Plant Industry. His headquarters, when not in the field, are at the department of botany, Michigan Agricultural College, East Lansing, Mich.

The University of Nebraska has conferred the doctorate of science degree on Patrick Joseph O'Gara, chief in charge of agricultural and smelter waste investigations for the American Smelting and Refining Company at Salt Lake City. For the past four years Dr. O'Gara has been making extensive investigations on the effects of gaseous and solid smelter wastes on vegetable and animal life.

Bulletin 510 of the United States Department of Agriculture, by C. J. Humphrey, deals with timber storage conditions in the eastern and southern states with reference to decay problems. The author discusses present conditions and methods of improving them; he also mentions and briefly describes a number of fungi that attack stored timber. The bulletin is an exceedingly valuable one, consisting of 43 pages and 41 figures.

A new manual of fruit diseases has just appeared.* This book treats the principal fungous diseases of garden and orchard fruits, the hosts, for convenience, being taken up in alphabetical order and the diseases in the order of their importance. This is the first attempt in America to group together in one volume all the available information on this subject and to put it in such form that it is readily available and understandable to the prac-

* Manual of Fruit Diseases by Lex R. Hestler and Herbert Hice Whetzel. Pp. i–xx + 1–462 with 126 figures. The Macmillan Company, price $2.00.

tical fruit grower. This text contains a detailed discussion of the cause of each disease so far as known so that the grower will not only be able to treat the disease properly but to understand why he is applying the remedy. So far as possible, the work is based on the practical experience of the authors of the book. F. J. S.

Technical Publication 8 of the New York State College of Forestry at Syracuse is a bulletin of 50 pages and 6 plates devoted to a discussion of the black zones formed by wood-destroying fungi. The author, Mr. A. S. Rhoads, does not claim to have fully solved this problem but he gives an interesting review of the literature and adds a number of results from his own investigations. The black zones are due to decomposition products formed in the decay of the wood, which infiltrate the cell walls to a greater or less extent, frequently becoming so abundant as to form numerous brown drops within the cells. The formation of these decomposition products is dependent mainly upon the concurrence of three factors: the presence of dead cells, an optimum supply of moisture, and a supply of oxygen sufficient to promote oxidation.

THE RUSTY-SPORED AGARICS

Volume 10, part 3, of *North American Flora,* by William A. Murrill, appeared June 25, 1917. The contents of this part may be indicated, as follows:

Genera	Total North American Species	New Species
Tapinia	2	
Paxillus	2	
Crepidotus	46	7
Tubaria	14	4
Galerula	33	8
Naucoria	65	21
Pluteolus	15	4
Mycena	12	2
Phylloporus	1	
Gymnopilus	85	13
Hebeloma	49	17
	324	76

For the accommodation of those preferring currently accepted names, the following new combinations are proposed for species described as new in *Galerula, Mycena,* and *Gymnopilus:*

GALERULA PARVULA	= **Galera parvula**
GALERULA CONIFERARUM	= **Galera coniferarum**
GALERULA GLABRA	= **Galera glabra**
GALERULA HEMISPHAERICA	= **Galera hemisphaerica**
GALERULA LIGNICOLA	= **Galera lignicola**
GALERULA DISTANTIFOLIA	= **Galera distantifolia**
GALERULA REFLEXA	= **Galera reflexa**
GALERULA MEXICANA	= **Galera mexicana**
MYCENA FLAVA	= **Bolbitius flavus**
MYCENA BRUNNEIDISCA	= **Bolbitius brunneidiscus**
GYMNOPILUS ALABAMENSIS	= **Flammula alabamensis**
GYMNOPILUS FIBRILLOSIPES	= **Flammula fibrillosipes**
GYMNOPILUS CASTANEUS	= **Flammula castanea**
GYMNOPILUS SQUAMULOSUS	= **Flammula squamulosa**
GYMNOPILUS FAGICOLA	= **Flammula fagicola**
GYMNOPILUS FLAVIDELLUS	= **Flammula flavidella**
GYMNOPILUS UNICOLOR	= **Flammula unicolor**
GYMNOPILUS PICEINUS	= **Flammula piceina**
GYMNOPILUS AROMATICUS	= **Flammula aromatica**
GYMNOPILUS LUDOVICIANUS	= **Flammula ludoviciana**
GYMNOPILUS ABRAMSII	= **Flammula Abramsii**
GYMNOPILUS LONGISPORUS	= **Flammula longispora**
GYMNOPILUS OREGONENSIS	= **Flammula oregonensis**

One species of *Hebeloma,* which had to be omitted from this part, is described, as follows:

Hebeloma cubense Murrill, sp. nov.

Pileus fleshy, convex, gregarious, 2 cm. broad; surface floccose with the remains of the veil, not striate, chestnut-brown; lamellae short-decurrent, crowded, broad, cinnamon, eroded on the edges; spores ellipsoid, regular, smooth, melleous under the microscope, 11–12 × 7–8 μ; stipe flexuous, tough, fibrous, cylindric, floccose-fibrillose, pale-brown, solid, whitened below, 4 cm. long, 3–4 mm. thick; veil white, floccose, appendiculate.

Type collected on soil in a garden at Herradura, Cuba, June 15, 1907, *F. S. Earle 560* (herb. N. Y. Bot. Gard.).

W. A. MURRILL.

INDEX TO AMERICAN MYCOLOGICAL LITERATURE

Bethel, E. *Puccinia subnitens* and its aecial hosts. Phytopathology **7**: 92–94. Ap 1917.

Blizzard, A. W. The development of some species of Agarics. Am. Jour. Bot. **4**: 221–240. *pl. 6–11.* Ap 1917.

Buchanan, R. E. Studies in the nomenclature and classification of the bacteria.—II. The primary subdivisions of the Schyomycetes. Jour. Bacteriology **2**: 155–164. Mr 1917.

Burkholder, W. H. The perfect stage of *Gloeosporium venetum.* Phytopathology **7**: 83–91. *f. 1–3.* Ap 1917.
Includes descriptions of *Plectodiscella veneta* sp. nov.

Conn, H. J. Soil flora studies. Part II. Jour. Bacteriology **2**: 137–154. Mr 1917.

Cook, M. T. Report of the department of plant pathology. New Jersey Agr. Exp. Sta. Rept. **1915**: 365–394. *pl. 1–5.* 1916.

Elliott, J. A. The sweet potato "soil rot" or "pox," a slime-mold disease. Delaware Agr. Exp. Sta. Bull. 114: 1–25. *pl. 1–5 + f. 1–13.* N 1916.

Fitzpatrick, H. M. The development of the ascocarp of *Rhizina undulata* Fr. Bot. Gaz. **63**: 282–296. *pl. 17, 18.* 16 Ap 1917.

Galloway, B. T. Newton B. Price. Phytopathology **7**: 143, 144. Ap 1917.

Hansen, A. H. Sandy sporophores. Torreya **17**: 55–58. *f. 1, 2.* Ap 1917.

Harris, J. A. The application of correlation formulae to the problem of varietal differences in disease resistance: data from the Vermont experiments with potatoes. Am. Nat. **51**: 238–244. Ap 1917.

Humphrey, H. B. *Puccinia glumarum.* Phytopathology **7**: 142, 143. Ap 1917.

Kligler, I. J. The evolution and relationship of the great groups of bacteria. Jour. Bacteriology **2**: 165–176. Mr 1917.

Lee, H. A. A new bacterial citrus disease. Jour. Agr. Research **9**: 1–8. *pl. A, 1, 2.* 2 Ap 1917.

Lloyd, C. G. Mycological notes—No. 45: 622–636. *f. 883–909 + portrait.* Ja 1917.

Contains notes on rare species of fungi received from correspondents.

Lloyd, C. G. Mycological notes—No. 46: 638–652. *f. 910–932 + portrait.* F 1917.

Includes notes on the genera *Mesophellia, Diploderma, Arachnion,* the *Xylarias,* etc.

Lloyd, C. G. Synopsis of some genera of the large Pyrenomycetes. 1–15. *f. 826–857.* Cincinnati. Ja 1917.

Camillea, Thamnomyces, and *Engleromyces.*

Mains, E. B. The relation of some rusts to the physiology of their hosts. Am. Jour. Bot. **4**: 179–220. *pl. 4, 5.* Ap. 1917.

Mains, E. B. Species of *Melampsora* occurring upon *Euphorbia* in North America. Phytopathology **7**: 101–105. Ap 1917.

Melampsora monticola sp. nov. is described.

Matz, J. A *Rhizoctonia* of the fig. Phytopathology **7**: 110–117. *pl. 2 + f. 1–3.* Ap 1917.

Rhizoctonia microsclerotea sp. nov.

McCubbin, W. A. Contributions to our knowledge of the white pine blister rust. Phytopathology **7**: 95–100. *f. 1.* Ap 1917.

Murrill, W. A. (Agaricales). Agaricaceae (pars), Agariceae (pars). N. Am. Fl. **10**: 77–144. 26 Ap 1917.

Includes descriptions of 107 new species in *Claudopus* (1), *Eccilia* (9), *Leptoniella* (14), *Nolanea* (11), *Pleuropus* (5), *Entoloma* (34), *Chamaeota* (1), *Pluteus* (30), and *Volvariopsis* (2).

Newman, L. E. The blister rust of white pine. Biltmorean **4**: 1–9. *f. 1–6.* 1917.

Orton, C. R. Diseases of the apple, pear and quince. Proc. Pennsylvania State Hort. Assoc. **1916**: 45–52. *f. 1–7.* 1916.

Orton, C. R. Diseases of the brambles and methods of controlling them. Proc. Pennsylvania State Hort. Assoc. **1916**: 66–71. *f. 1–7.* 1916.

Patterson, F. W., & Charles, V. K. Some common edible mushrooms. U. S. Dept. Agr. Farm. Bull. 796: 1–24. *f. 1–22.* Mr 1917.

Rhoads, A. S. The black zones formed by wood-destroying fungi. N. Y. State Col. Forest. Tech. Publ. 8: 1–60. *pl. 1–6.* Mr 1917.

INDEX TO VOLUME IX

Because of the amount of original manuscript on hand and the increased cost of paper and printing, no separate index to this volume will be issued, but a complete index to the first ten volumes of MYCOLOGIA will be published at the close of 1918

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